A STUDY OF INTROVERT-EXTRAVERT RESPONSES TO CERTAIN TEST SITUATIONS

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By
RAYMOND ALFRED SCHWEGLER

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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN THE FACULTY OF PHILOSOPHY, COLUMBIA UNIVERSITY

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ACKNOWLEDGMENT

This study would have been impossible without the generous and patient coöperation of many of the officials and teachers of the public school systems of Lawrence, Kansas, and of Kansas City, Missouri. To the respective superintendents, principals, and teachers concerned, deep appreciation is hereby reaffirmed.

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Whatever of merit, if any, this study may possess is due to the patient and generous coöperation of these and many others who gave of time and strength and knowledge whenever they were asked.

R.A.S.

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CHAPTER I

INTRODUCTION

Introversion Defined

The concept of introversion-extraversion has gained wide attention within recent years. It holds the promise of a fruitful approach to the confused tangle of neurotic, psychopathic, and delinquent behavior patterns, and is, for that reason, peculiarly attractive to the student of atypical childhood.

The terms, introversion and extraversion, were first suggested by Jung [1][1] in 1913, and were further elaborated in his later writings. Klüver [2] summarizes Jung's point of view by saying that "for Jung . . . the subject-object relation plays the decisive rôle. . . . The subject-object relation is a relation of adaptation. . . . Extraversion means an outward turning of the libido. . . . Introversion means an inward turning of the libido upon the self." Jung later develops this somewhat cryptic definition in his work on *Psychological Types* [3].

Tansley [4] thinks that introversion is essentially a failure of the mind to function outwardly, a lack of adaptation; the psychic energy fails to find natural outlets, and, being thus cut off from the external world, develops an internal world of its own. The trend toward introversion rests upon an inherited basis, and, although it may not be thought of as the ideal adaptation, yet it has enriched life by its secondary reactions with the external world.

McDougall [5] conceives of introversion as a state of affairs implying inhibited expression of emotional trend, resting on an inherited basis. Relying largely on Jung's original characterization of the two types, he finds a definite relationship between the temperamental types of introversion-extraversion and Kretschmer's [6] "Schizoids and Cycloids." McDougall is particularly

[1] Numbers in brackets refer to correspondingly numbered titles in the Bibliography at the end of this study.

impressed with the close relationship of introversion with psychasthenic [2] and schizophrenic symptoms,[3] and of extraversion with hysteria and manic-depressive trends. McDougall thinks that introversion is not a character-quality, but rather an inherited temperamental factor, and that "we may assume that the position of any subject on the scale of introversion-extraversion is a function of some quite general property of his nervous system . . . a function of some chemical product or products of metabolism."

Kempf [7] suggests that introversion may be accounted for at least in part by a predisposition to affective dissociation. According to him, the socialized interests of the individual are in constant conflict with the self-indulgent affective cravings. When the latter are persistent and powerful and the social interests weak and depressed, the self-indulgent affective cravings break through in the form of interference products of various types.

Marston [8] defines extraversion as the skeletal expression of emotion, introversion as the dissipation of emotionally aroused energy within the organism rather than the adequate discharge of this energy through skeletal channels upon the environment. "According to this distinction the underlying neural mechanism for extraversion is the cerebrospinal system, for introversion the autonomic system."

Freyd [9] in his study of types was deeply impressed with the social implications of introversion and extraversion. After extended quotations from various authorities, he offers a list of fifty-four behavior traits, chiefly social in nature, which he considers earmarks of introversion and extraversion. Freyd raises the question of the validity of the concepts, and suggests the possibility that they represent forms of contrasting behavior patterns in which social adjustment is the most prominent factor, and that introversion and extraversion are merely the extreme points on a normal distribution of social adjustment trends.

Many of the authors who have written on the question of introversion-extraversion are impressed with the probable presence of an hereditary predisposing factor. Some even go so far

[2] Psychasthenic symptoms are conceived of as having to do with phobias and compulsions which are characteristic of psychasthenia.

[3] Schizophrenic symptoms are found in schizophrenia, which itself is a general synonym for dementia praecox or adolescent insanity, and is characterized by contraction of the emotional life, by a loss of contact with objective reality, and by bizarre behavior, accompanied by a more or less complete abandonment of all social responses.

as to assert that there are definitely significant body forms and physical constitutions which predispose toward behavior patterns like those here under discussion. For example, Kretschmer's [6] pyknic [4] and asthenic [5] types represent an intensive effort to show the relationship between constitution and behavior. Naccarati and Garrett [10] picture the micro- and macrosplanchnics [6] as associated with behavior patterns which may be thought of as essentially introverted and extraverted, respectively.

It would appear from this survey of the literature that introversion is conceived of as a relatively persistent integration of neural bonds in consequence of which there is a marked tendency to respond to life situations by covert, central, and organic behavior, and that extraversion is a similarly persistent tendency to respond to life situations by overt skeletal behavior. This is true whether we approach the matter from the point of view of prevailing mind set (Conklin [21]), or energy flow (Jung [1], Downey [11], Marston [8]), or inner stresses and their resultant interference products (Kempf [7]).

From the literature referred to above it would seem as though in their extreme forms both introversion and extraversion presented many of the earmarks of the psychopathic, neurotic, and otherwise unstable types described in the literature of the psychoses and the neuroses, and that a more careful study of the behavior patterns subsumed under the above titles might very properly challenge the attention of the psychologist.

Recent Experimental Investigations

Within recent years there have been a number of experimental studies of introversion-extraversion. Many of them have been based on the list of fifty-four traits proposed by Freyd [9] in the paper above referred to.

1. Downey [11], commenting on the relationship between Jung's doctrine of psychological types and her own will-temperament patterns, suggests that her tests for speed of movement, speed of decision, freedom from load, and flexibility would differentiate between the two types in question.

2. Travis [12, 13], approaching the matter from the angle of

[4] Thick-set, stocky, as opposed to slender.

[5] Asthenic implies physical weakness and inadequacy of organic development.

[6] Microsplanchnics are defined as persons with small vital organs. Macrosplanchnics are defined as persons with large vital organs.

schizophrenia[7] and the psychoneuroses, suggests that sufferers from the former are neither suggestible nor susceptible of hypnotic control, while those presenting the latter are suggestible. He proposes to measure suggestibility by a crystal-gazing technique [14] and finds that the results gained from the study of fifty-nine cases from the Psychopathic Hospital of the University of Iowa confirm the theory. McDougall accepts the theory as demonstrated [5].

3. Allport (F.H.) [15], in discussing the characteristics of introvert behavior, suggests the use of a word association test, but gives no data to prove the utility of the procedure.

4. Laird [16], using a number of the items mentioned by Freyd and by Woodworth, devised a series of graphic scales or "spotting tests," of which Scale C is for introversion and extraversion. The scales suggest on the one hand the personal inventory of Woodworth and, on the other hand, Freyd's graphic rating scale [17].

5. Hoitsma [18], reporting on the reliability and relationships of the Laird Spotting Tests, notes a coefficient of reliability of .674 ± .039 for Test C when the test was repeated by eighty-eight subjects after a lapse of two weeks, and of .45 ± .003 when the first half is correlated with the second half, using this time the test results of 288 women. He explains the modest reliability by pointing to the small number of items employed in Test C. There were fifty-three items. Test B has a reliability coefficient of .85 when two trials are used. Hoitsma finds a correlation of .35 ± .069 between performance on Test C and scholarship.

6. Heidbreder [19] undertook to measure introversion-extraversion by using Freyd's list as the basis for a rating scale. Each of nine hundred students in the University of Minnesota was asked to rate himself and to have two other students rate him; two hundred cases were selected as a random sample and the results were treated statistically. The scores formed a normal frequency distribution, with the extraverts at the low end and the introverts at the high end. The norm was —11.25 ± P.E. .30. The normal person is slightly extravert. Heidbreder agrees with Tansley that the biological purpose of neural integration is extravert behavior. Quoting further from Paterson and Ludgate [20], the author points out that, since positive aggressive traits

[7] Dementia praecox or adolescent insanity.

predominate over ratings indicating their opposites, therefore even a slightly introvert tendency indicates a greater departure from the norm than would a somewhat larger extravert tendency. Heidbreder finds a correlation of $r = .55$ between self-ratings and associate ratings. Examining the items of her scale one by one, she concludes that thirty-one are diagnostic in every case, and that only six of them can be thought of as having no value whatever for the purpose in hand. She finds that the introvert end of her rating distribution is the more doubtful, because "as a class they are the more baffling."

7. Conklin [21], approaching the question of introversion-extraversion from the point of view of the types of situations to which they are attentive, expects the extravert to tend toward objective, concrete conditions, while the introvert would tend toward subjective, abstract materials. Conklin concludes that most individuals are ambivert, being neither exclusively introvert nor extravert but somewhere between, and that the fairest measure would be a ratio between the contrasting trends. Using twenty items which he describes as diagnostic of introversion and twenty others which are thought of as diagnostic of extraversion, he asks each of his subjects to rate himself quickly on a nine-point pleasure-displeasure scale with reference to each of the forty items. The self-correlation of the ratios is .92. Conklin concludes that this "E-I ratio" has distinct possibilities in vocational guidance. It appears to have promise of value.

8. Heidbreder [22] has made a study more recently of sex differences in introversion and extraversion. Using the same data as in her earlier study [19], she concludes that there is no evidence that there is any significant sex difference, that both sexes have about the same scores, and that both tend more to extraversion than to introversion. There are differences in connection with particular traits. The method employed was to find for each of the fifty-three items used the per cent of men and the per cent of women for whom the trait was diagnostic, to find the difference, and to divide that difference by its probable error. Heidbreder disagrees with Laird, who finds so large a sex difference that he provides separate norms for men and women.

9. Guthrie [23], after critically surveying the literature with special reference to the meaning of the terms, introversion and extraversion, and to the tests which are supposed to be diagnos-

tic, applies a battery of six tests to a group of University of Washington students, and concludes that, since the intercorrelations between these tests are low, they do not, therefore, measure the same thing, and, since they are all supposed to measure introversion-extraversion, he doubts whether any of them do. The logic is interesting if not convincing. The tests used are: (1) Form C2 of Laird's Spotting test, (2) a campus information test, (3) an association test given as a group test and scored on the basis of community of response, (4) judging of teachers as to their excellence, (5) scholarship, and (6) intelligence. The results of each of these "tests" showed a fair reliability, but very low intercorrelations, as has been indicated.

10. Marston [8] made an experimental study of introversion and extraversion in connection with his work in the preschool psychological laboratories of the Iowa Child Welfare Research station at the University of Iowa. He developed a rating scale and tried a number of experimental test situations "to determine to what extent young children's reactions to their environment, particularly social, are conditioned by constant tendencies to introversion and extraversion." Marston, using one hundred children between the ages of two and six years, finds that there are three types, introvert, extravert, and ambivert, that the rating scale technique is adequate for the diagnosis of these types, and that marked individual differences exist as between introverts and extraverts among young children in (*a*) social resistance to a stranger, (*b*) in compliance with a difficult request, (*c*) in interest reactions to a varied and novel environment, and (*d*) in self-assertion in response to the denial of their wishes. He finds a correlation of .52 for boys and .54 for girls between the sum of the scores on the tests and ratings. While there is no clear correlation between either chronological age or mental age and extraversion, there seems to be some decrease in extraversion with age, especially with girls. Marston's study is the first which undertakes to study the behavior of introverts and extraverts experimentally.

On the basis of these studies, the following statements are warranted:

a. It appears to be generally assumed—though not proved—that the conditions named rest on a basis of inheritance, that

they really represent gradations on a scale, of which extreme introversion with concomitant trends toward schizophrenia [8] and psychasthenia [9] forms one end, and extreme extraversion with similarly concomitant tendencies toward manic-depressive insanities and hysterias forms the other end. The great mass of persons is conceived of as falling somewhere near the middle of the scale, with a possible slight shift of the mean toward extraversion. This median group is referred to as ambivert. The three groups together are thought of as forming a continuous distribution.

b. There is a striking resemblance between the typical concept of introversion and extraversion and clinical pictures described as "neurotic," "psychopathic," "inferior," "constitutionally inferior," "inferior psychopathic," "prepsychotic," "problem case," and other categories indicative of undesirable integration of stimulus-response bonds.

c. The existence of introversion-extraversion is being taken generally for granted, in part on the basis of authority and in other part because of the evidence of life experience, which seems to point toward the plausibility of the types in question. The only experimental evidence in which actual behavior reactions of an objective type are offered as evidence is that of Allport, of Marston, and possibly of Downey.

d. Little or no evidence is at hand with reference to the bearing of chronological age and of mental age on introversion and extraversion.

e. Little or no attention has thus far been paid to the relation of introversion-extraversion to (*a*) educability, (*b*) the possible bearing on the correlation of intelligence and school achievement, (*c*) the doctrine of individual differences, (*d*) the problems of moral and social education, (*e*) the questions of educational and vocational guidance, and (*f*) the field of mental hygiene.

The Purpose of This Study

The purpose of this study was threefold. It was proposed:

1. To find whether it is possible to establish any statistically reliable behavior differences between two groups of adolescent children selected because of their tendency toward introversion on the one hand and extraversion on the other hand.

[8] Schizophrenia, a technical term for adolescent insanity.
[9] Psychasthenia, a neurosis characterized by phobias or by compulsions or both.

2. To find whether a tendency toward introversion or extraversion is related to chronological age in any significant degree.

3. To find whether a tendency toward introversion or extraversion is significantly related to intelligence.

As a working hypothesis for this study, introversion and extraversion are conceived of as contrasting behavior patterns having to do with social contact-making. Extraversion is thought of as tending to facilitate social contact-making, while introversion is thought of as tending to embarrass or impede social self-expression. Just as idiocy and genius form the extreme ends of the scale of intelligence, with average intelligence characteristic of the great mass of human beings, so dementia praecox is the extremest degree of introversion or social contact-making and manic-depressive insanity the extremest degree of extraversion or social contact-making. The average human being lies somewhere between these two extremes of social adjustment. The dementia praecox patient has practically lost the power of making human contacts; the introvert has marked difficulty in making them; the normal or ambivert person makes his contacts with average ease and effectiveness; the extravert makes his contacts with marked ease, and the manic-depressive expresses his contact-making trends with pathological and unbridled facility. With reference to this trait of human contact-making, human beings are, for the purposes of this study, thought of as representing a continuous distribution, with introversion near the lower end and extraversion near the upper end of the scale.

The Plan of the Study

If there actually are introverted and extraverted persons, then this condition ought to affect reactions to experimentally controlled situations, and the differences in the behavior of the two types ought to be susceptible of statistical demonstration.

On the basis of this assumption, two groups of young white persons were carefully selected by means of the Marston [8] scale. The first group was composed of 103 introverts, and the second group contained 103 extraverts, paired with the first group on the basis of age, sex, race, grade placement, and approximate social status. The ages ranged from twelve years and six months to eighteen years and nine months. The cases were all selected from the junior and senior high school of Lawrence,

Kansas, or from similar schools of Kansas City, Missouri, and in each case each pair of cases came from the same school.

A battery of twelve different tests, which were thought to have promise of differentiating power, was given to these subjects. Three of the tests were group tests. The rest were individual tests. The twelve tests employed in this study were selected from a group of over forty procedures which had been examined over a period of four years. In order as given, the individual tests were as follows:

1. A multiple choice test to measure speed of emotionally conditioned choice.
2. Choosing the heavier of three boxes, all three being equal in weight. Score in terms of time.
3. Suggestibility, based on the manner in which the choice of boxes was made.
4. Motor output, speeded and unspeeded, based on Downey's test "Freedom from Load." [24]
5. A free association test of one hundred words, based on Jung's technique. [25]
6. Choosing one of five cards, a cash prize rewarding the drawing of "a king."
7. Response to standard ink blots. [26]
8. Suggestibility based on response to questions asked about the Dutch home picture of the Binet Series.
9. Color-naming, using the Woodworth-Wells technique. [27]

The three group tests were:

1. McCall's Multimental Scale, Elementary Form I. [28]
2. An Abbreviated Questionnaire modelled after Woodworth. [29]
3. An Abbreviated Form of Travis' Character Test. [30]

The tests named above will be described in later pages. The three group tests required forty minutes altogether. The nine individual tests in each school consumed about sixty minutes for each child. The group tests were given in each school at one sitting, after all the children of that school had taken the individual tests.

The testing was done either by the writer himself or under his direction by five other persons trained for the purpose. These workers were in each case trained to give psychological tests and

had been specially instructed for this study by the writer. Three of them were on the testing staff of either the Lawrence or the Kansas City, Missouri, school system, and the remaining two are graduates, one of Stanford University and the other of the University of Kansas. Their previous training and interests had especially fitted them for participation in the study. Each tester was equipped with identical typewritten directions,[10] with instructions to follow them verbatim, and each one did some of his work in the presence of the writer. It is reasonable to believe that the results are for all practical purposes comparable and reliable.

In each of the seven schools selected for this study, special quarters were assigned for the testing. In the five Kansas City Schools, the rooms usually employed for psychological testing were placed at our disposal. In the two Lawrence Schools, vacant classrooms were made available. The tests were carried out under standard conditions as far as quarters, lighting, and ventilation were concerned. Testing began shortly after 8:15 in the morning in the Kansas City schools and continued until 2 P.M. except in the case of the Northeast Junior High School which had afternoon sessions only. Testing here began about 12:30 P.M. and continued till 5 P.M. In Lawrence, the testing began about 9 A.M. and continued till about 3 P.M. each school day, with a noon interval for luncheon. Every effort was made to secure the full coöperation of each child before proceeding with the test.

The scores derived from these tests and their relationship to introvert-extravert criterion ratings were made the basis of an extended statistical analysis in order to determine whether any of the tests actually and reliably differentiated between the conditions of introversion-extraversion, and what influence, if any, the factors of age and intelligence exerted upon the situation.

The differential value of test scores may be studied in any one of three ways: first, by finding the difference and the reliability of the difference between the means of the performance of the two groups on each of the tests studied; second, by finding the overlap and the reliability of the overlap of the contrasted series of scores; and, third, by finding the correlation between test

[10] Copies of the directions will be found in connection with the discussion of each of the tests in the following chapters.

performance and rating on the Marston Scale of introversion-extraversion. If there were reliable differences between the means of the contrasted series of scores, or if the overlap of scores was reliably small, or if the correlation between criterion rating and test scores was significantly large, then the condition of extraversion-introversion might be thought of as being reliably indicated. All three methods were employed, and the findings are presented in this report.

The computation of correlation was carried out in two ways. First, the product-moment coefficient of correlation between criterion rating and test scores was calculated by the usual Pearson formula, and then, in order to compensate for misplacements on the criterion scale caused by probable minor errors in judges' ratings, as also to compensate for the extreme dichotomy of these ratings, the biserial r [11] [31] was calculated as between the test performances of the two contrasted groups as groups rather than as individuals.

The question of the correlation between criterion scores and age and intelligence, both singly and in combination, was likewise attacked by the methods mentioned above whenever possible.

To determine to how great a degree intelligence and maturity affected the test scores, similar correlation studies were carried out between each of the test scores considered and the factors of age and intelligence, both singly and in combination. The most significant of the results thus secured are presented in the pages of this report.

Some of the results of the study were sufficiently encouraging to suggest the development of a regression equation based on the most promising test scores. The results are presented as a pioneer venture in this special field.

Limitations of space prevent the presentation of all but the most significant statistical findings in this report. The full report is on file in the Library of Teachers College, Columbia University.

[11] The Biserial r formula used in this study is formula 201, described by Kelley in section 70, page 248, in his text, *Statistical Method*. The standard error of this coefficient was calculated by the use of formula 204 on page 249 of the same text.

The standard error of the overlap was calculated by the use of formula 302, found in section 87, page 318, of the same text.

CHAPTER II

ASSEMBLING AND RATING THE CONTRASTED GROUPS

The Criterion Described

The criterion employed in determining introversion-extraversion was an adaptation of the rating scale devised by Leslie R. Marston in connection with his study, *The Emotions of Young Children.* [8]

The Marston Scale was originally developed by selecting twenty items from Freyd's list [9] of fifty-four characteristics of introversion-extraversion. It was based upon the assumption that "it should be possible to differentiate the two types [introverts and extraverts] by their reactions to situations that exaggerate the opposing tendencies in the respective types." Freyd had listed fifty-four of these tendencies. Marston proposed to portray these behavior distinctions by a system of ratings "made on the basis of long and intimate contacts with the individual to be classified." After extended trial, he found the scale to be "a reliable rating instrument . . . definitely diagnostic of introversion and extraversion." [1] Marston asserts that the scale is "based upon the definition of introversion-extraversion in terms of socially conditioned energy discharge."

The scale as used in this study consists of twenty-five pairs of contrasted traits, relating to various aspects of social-contact behavior. In each pair of traits, one member, marked with a star, describes the behavior of the extravert, while the unstarred member describes the response of the introvert to the same situation. The complete scale, together with directions for use, is reproduced on pages 13 to 15.

Marston's scale, since it was devised for the purpose of rating young children did not include certain behavior trends which

[1] The writer is indebted to Dr. Leslie R. Marston for permission to use his scale as here indicated.

would appear more clearly with the onset of adolescence. The writer, therefore, in order to adapt the range of the scale more completely to his problem added the six items numbered 10, 12, 13, 23, 24, and 25. Item 20 of the Marston list was dropped, since it substantially duplicates his item, 10, which is shifted to the twenty-second place in the scale used here.

TREND RATING SCALE

	GROUP	
Name of Subject		
Born ..... 19.... Sex ..... Grade		
School ..... Room		
City		
	SCORES	
How long have you known this person?	1	14
.....	2	15
	3	16
Are you related to this person?	4	17
.....	5	18
	6	19
What opportunities have you had to observe the conduct of this person?	7	20
	8	21
.....	9	22
	10	23
	11	24
	12	25
	13	

INSTRUCTIONS TO RATERS

1. Consult no one in forming your judgments. We want your estimate of this person uninfluenced by what others may think or say of him. RATE INDEPENDENTLY.
2. Do not let the Subject know that he is being rated, regardless of your conclusions about him. Do not talk to anyone about the matter.
3. In rating on a particular trait, disregard every other trait for the moment save that one. Many ratings are worthless because the rater allows himself to be influenced by a general impression favorable or unfavorable, which he has formed about the person being rated. RATE IMPARTIALLY.
4. In the list of paired contrasting traits that follow on pages two and three mark that member of each pair which correctly describes the person whom you are describing with *two plus marks* (+ +). Make your marks inside of the appropriate parentheses. If neither statement of a pair of traits correctly describes him, mark the trait toward which he most clearly inclines with *one plus mark* (+). If you cannot decide that

one statement of a pair is more applicable than the other, mark *both* with a *minus mark* (—) (—). Make all your marks plainly and in the parentheses by the side of the trait you have selected as appropriate.

TRAIT-PAIRS

Mark one member of each pair unless neither member describes your subject. Read directions on first page carefully.

1. ( )	Is self-conscious; easily embarrassed; timid or 'bashful.'	( ) *Is self-composed; seldom shows signs of embarrassment; perhaps is forward or 'bold.'
2. ( )	Avoids talking before a group; when obliged to talk before a group, finds it difficult.	( ) *Eager to express himself before a group; likes to be heard.
3. ( )	*Prefers group activities, work or play; not easily satisfied with individual projects.	( ) Prefers to work and play alone; tends to avoid group activities.
4. ( )	*Insistent upon the acceptance of his ideas and plans; argumentative and persuasive.	( ) Not insistent upon the accept ance of his ideas and plans agrees readily with others wishes; compliant and yielding
5. ( )	Inclines toward activities requiring care; good in details; "careful."	( ) *Prefers activities demanding pep and energy, but not exacting care; perhaps is neglectful of details.
6. ( )	Deliberative; slow in making decisions; perhaps even on minor matters, overcautious.	( ) *Impetuous and impulsive; may plunge into situations where forethought would have deterred him.
7. ( )	*Keenly alive to environment, physical and social; lively curiosity.	( ) Rather indifferent to external events; tends to detachment from environment.
8. ( )	*Self-confident and self-reliant; tends to take success for granted; strong initiative; prefers to lead.	( ) Lacking in self-confidence and initiative; a follower.
9. ( )	Reserved and distant except to intimate friends; does not form acquaintanceships readily.	( ) *Hearty and cordial, even to strangers; forms acquaintanceships very easily.
10. ( )	*Enjoys canvassing, selling papers, competing with others.	( ) Shrinks from selling or other activity which implies competitive contacts. Prefers mechanical activities.
11. ( )	*Rather insensitive and indifferent to others' opinions; independent.	( ) Very sensitive and easily hurt; reacts strongly to praise or blame.

12. ( ) *Entirely at home with members of the opposite sex.	( ) Definitely inclined to limit acquaintances and friendships to members of his own sex.
13. ( ) A poor loser. Becomes much upset, even ill, after defeat in competition with others.	( ) *A good loser, takes defeat without upset. "A good sport."
14. ( ) *Not given to worry or anxiety; carefree.	( ) Worries over possible misfortunes; 'crosses bridges before coming to them.'
15. ( ) Shows preference for a narrow range of intimate friends, and tends to exclude others from his association.	( ) *Seeks broad range of friendships; not selective or exclusive in games, etc.
16. ( ) Slow in movement; deliberative or perhaps indecisive; energy output moderate or deficient.	( ) *Quick and decisive in movement; pronounced or excessive energy output.
17. ( ) Shrinks from making new adjustments; prefers the habitual to the stress of reorganization required by the new.	( ) *Adaptable to new situations; makes adjustments readily; welcomes change.
18. ( ) *Turns from one activity to another in rapid succession; slight perseveration tendency.	( ) Marked perseveration tendency; does not abandon an activity readily regardless of success.
19. ( ) Emotions not freely or spontaneously expressed.	( ) *Emotions, such as, sympathy, delight, sorrow, anger, jealousy, etc., readily expressed.
20. ( ) Secretive; seclusive and 'shut-in'; not inclined to talk unless spoken to.	( ) *Frank; talkative and sociable; does not stand on ceremony.
21. ( ) *Makes the best appearance possible; inclined to 'bluff' or 'show off'; perhaps conceited.	( ) Often presents himself at a disadvantage; modest and unassuming; underestimates his own abilities.
22. ( ) Tends to depression; frequently gloomy or moody.	( ) *Tends to elation of spirits; seldom gloomy or moody.
23. ( ) Yields readily and more or less cheerfully to superior authority.	( ) *Becomes stubborn, grouchy, and obstinate under discipline and control.
24. ( ) *Enters heartily and with enjoyment into the spirit of social intercourse.	( ) Prudish, awkward, easily embarrassed in his social contacts.
25. ( ) Non-aggressive; inadequate force and "pep." A "good child" that "never gives any trouble."	( ) *Aggressive, full of "pep," will try anything once.

Marston's method of translating the ratings into scores was reversed, so that extreme introversion counted as five points on each item, and extreme extraversion counted as one point on each item. Reference to the rating scale will show that the traits to be rated are presented in contrasting pairs, of which one is characteristic of the introvert, while the other is the earmark of the extravert. In each pair, the extravert trait is marked with an asterisk. Table I represents the key used in transmuting judges' ratings into numerical criterion scores. The maximum possible numerical score on the scale is 125, which would represent extremest introversion. The higher the score, the more marked the introversion. The lowest possible score, 25, would be the score of extremest extraversion.

TABLE I

KEY USED IN REDUCING JUDGES' RATINGS TO NUMERICAL SCORES

(++)	= Introvert trait strikingly present	5 points
(+)	= Introvert trait present	4 points
(−) (−)	= Neither trait clearly present to the exclusion of the other	3 points
*(+)	= Extravert trait present	2 points
*(++)	= Extravert trait strikingly present	1 point

The midpoint on the scale would be seventy-five, which might for the moment be empirically accepted as the transition point on the scale from extraversion to introversion. It will appear later that the scores given by the judges actually tend to group themselves around the midpoints of the introvert and extravert sections of the scale as just described.

SELECTING THE SUBJECTS

The subjects of this study were drawn from the regularly enrolled pupils of seven secondary schools, of which two, as has been stated, are located in Lawrence, Kansas, while the remainder are in Kansas City, Missouri. At the time of this study, these seven schools had a total enrollment of 10,344 students.

A faculty meeting was held in each of the coöperating schools, at which the concept of introversion-extraversion was presented and discussed. Copies of the schedule entitled, "General Trends of the Schizoid Make-Up," were distributed to the teachers, and were employed as the basis of the discussion. Immediately at the close of the discussion, the teachers were asked to write down

from their class rolls the names of those of their white students who seemed to fit the description of the extreme introvert as presented on this schedule. The names thus secured formed the basic introvert list.

A copy of the trend rating scale (see page 13) was next sent to each teacher of every child so mentioned, with the request that the teacher rate each child to the best of his ability on all of the twenty-five behavior traits mentioned in the list, following carefully the directions on the first page of the rating scale. The ratings of each judge were next transmuted into numerical scores, using the key described in Table I.

GENERAL TRENDS OF SCHIZOID MAKE-UP

1. *General Health*

   Average to good.
   Sometimes poor circulation, pallor, acne.

2. *Dynamic Drive*

   Lacks "pep" and forcefulness. An outstanding trait.
   Bashful, timid, with lack of energy.

3. *Intelligence*

   Usually, but not always, average or better.
   Often a child of unusual promise.

4. *Emotional Tone*

   Undemonstrative, displays his feelings very little.
   Tends to apparent barrenness and monotony of emotional tone.
   May give the impression of extreme moodiness, definitely out of step with the facts of the objective environment.
   Occasional outbursts of intense feeling, which seem out of proportion to the actual objective situation.

5. *Social Adjustment*

   Prefers solitude to social contacts, not antisocial, but unsocial. Few friends, ordinarily no confidants.
   Restrained, embarrassed, cannot "let himself go."
   An onlooker rather than a participant in human affairs.
   Shut-in personality, neither invites nor seeks human contacts.

6. *Work Habits*

   Tends to work erratically, in spurts, with periods of aimless reverie.
   Tends to marked interest in music, art, poetry, abstract philosophy. and away from concrete reality.
   Avoids types of activity which involve human contacts, i.e., selling, competition, prolonged coöperative effort.

7. *Play and Recreation*

Has restricted range of play outlets.
Prefers solitary games and amusements.
Spends much time in brooding and reverie.
An onlooker in group games rather than a participant.

8. *Trends*

Odd and careless in dress, manners, and speech.
Negativistic, resents suggestions, is irritated under control.
Self-absorbed, devoted to reverie, and fits of abstraction.
Bashful and awkwardly clumsy when approached.
Avoids persons of the opposite sex, or, at any rate, does not actively seek their companionship.
Sudden, erratic, unexplained freaks of behavior.
Mannerisms, queer habits, oddities of behavior.
Often markedly religious.

Each judge's score was the sum of the ratings which he gave on the twenty-five items which constitute the scale. For the purposes of this study, any judgment was thought of as indicating introversion if the sum of the ratings on the twenty-five traits exceeded eighty. In like manner, a judgment was thought of as implying extraversion if the sum of the twenty-five ratings was less than seventy.

If three or more judges returned ratings on a child, and if at least three of the judges agreed that the child in question was introvert, and, if the average of the ratings of all the judges was eighty or more, the child was accepted as probably introvert. The limit of eighty mentioned above was set empirically, and may be justified by referring to Table V, where the frequency distributions of the averages of the judges' ratings may be found. From that table, it will be seen that eighty represents closely a point on the scale three sigmas below the mean of the ratings given to the introvert group.

One hundred and seven introvert children were found by the above procedure in the school population examined.

A request was next made of the teachers that they submit from their class rolls the names of all the children whom they considered to be extraverts. As a guide, the sheet entitled, "General Trends of Cycloid Make-Up" was distributed to the teachers and from their responses a second master list was built up. From the office records of the schools, the age, sex, grade, and approximate social status of each of the children named were

GENERAL TRENDS OF CYCLOID MAKE-UP

1. *General Health*

   Average to good.
   Circulation and digestion usually good.

2. *Dynamic Drive*

   Abundant "pep" and forcefulness. An outstanding trait.
   Aggressive, alert, unabashed.

3. *Intelligence*

   Usually at least average, though it may be of any level. Not given to deep or prolonged reflection. Practical rather than abstract.

4. *Emotional Tone*

   Demonstrative, displays his feelings freely.
   Reveals a rich, many-sided emotional life, full of ups and downs.
   Tends to oscillation between exaltation and depression.
   Emotional expression tends to be pure, naïve, undistorted by timidity, bashfulness, or caution.

5. *Social Adjustment*

   Craves and actively seeks social contacts.
   Has many friends. Is "hail fellow, well met," always welcome.
   Unrestrained, unembarrassed, "lets himself go" easily and completely.
   "The life of the party."
   A leader and organizer of human affairs.

6. *Work Habits*

   Abundant energy output, except at times of depression. Tireless.
   Little or no time for reverie and brooding, except when depressed.
   Inclined toward self-assertion, sometimes boastful; not at all retiring or bashful.
   Tends to marked interest in concrete things and situations.
   Avoids philosophical or theoretical abstractions.
   Seeks and enjoys types of activity which involve human contacts.
   A good organizer and salesman, of himself and other things.

7. *Play and Recreation*

   Vigorous, restless, jolly. Has an extensive and varied range of play.
   An active participant in all forms of social play and recreation.
   Enters intensely and whole-heartedly into work and play.

8. *Trends*

   May exhibit marked oscillations of mood.
   Shows exaggerated frankness and lack of restraint in the expression of thoughts, feelings, and moods.
   Is often markedly talkative, and over-active.
   May be inclined to "mix" into affairs that do not concern him.
   Is easily distracted by competing stimuli.

ascertained. Only white children were considered. From this second master list, mates matched with the introvert cases in age, sex, race, grade placement, and social status were selected, and trend ratings were secured, following the same procedure as was followed in the case of the introvert group. The upper limit of seventy points on the scale was finally accepted for the extravert group, since it is nearly three sigmas above the mean of the ratings of the extravert group. Actually, none of the average extravert ratings rise above sixty-seven. Whenever the average of the ratings returned by the judges—in no case less than three—exceeded seventy, the cases were rejected as doubtful. When a case was thrown out because of an unsatisfactory rating, a new name was selected from the extravert master list of the same school, approaching the introverted mate as closely as possible in age, sex, race, grade placement, and social status.

It was finally possible to locate one hundred and three matched pairs of pupils, of which no introvert was rated lower than eighty on the rating scale, and no extravert higher than seventy, and with reference to all of whom not less than three judgments, all in substantial agreement, had been returned. Table II presents the distribution of the number of ratings returned for the subjects used in the study.

It appears that the extravert by virtue of his greater partici-

TABLE II

NUMBER OF CHILDREN RATED RESPECTIVELY BY THREE, FOUR, AND FIVE JUDGES

Based on Data of Table IV

No. Judges Rating	Introvert	Extravert	Total
3	76	29	105
4	25	71	96
5	2	3	5
Total No. Cases	103	103	206
Average No. Judges	3.28	3.74	3.51
Total No. Ratings	338	386	724

pation in the social life of the school was better known, and barring the complications of pairing, it proved easier to secure an adequate number of ratings on the extraverts as a group than on the introverts.

The pairs of subjects finally selected for the study were distributed among the seven schools as shown in Table III.

TABLE III

NUMBER OF PAIRS OF BOYS AND GIRLS SELECTED FROM THE POPULATION OF EACH OF THE COÖPERATING SCHOOLS, AND ALSO THE TOTAL ENROLLMENT OF EACH OF THESE SCHOOLS DURING THE SPRING TERM, 1925–26

SCHOOL	BOYS	GIRLS	TOTAL	ENROLLMENT
Lawrence Senior High	8	11	19	625
Northeast Senior High	8	8	16	1,963
Central Senior High	11	4	15	2,553
Lawrence Junior High	6	2	8	685
Northeast Junior High	9	4	13	1,327
Central Junior High	9	4	13	1,743
Westport Junior High	12	7	19	1,448
Total No. Pairs	63	40	103	
Total Enrollment				10,344

THE RATINGS OF THE JUDGES

Table IV presents the ratings given by the several judges for each child included in the study. The score finally used as the criterion for each child is the average of all the ratings secured for that child.

The raters who coöperated in this study were all teachers or officers in the schools in which the investigation was carried on. The rating was done during April and May, 1926, after the judges had had at least the better part of a school year in which to become acquainted with their students. In no case was anyone asked to rate any child that was not enrolled in that judge's classes. In this way a definite background of personal contacts might fairly be assumed. The teachers were in every case either college graduates or persons with long teaching experience. Many of them were graduate students who had been trained in Educa-

TABLE IV

ACTUAL RATINGS MADE BY THE SEVERAL JUDGES ON EACH OF THE CASES INCLUDED IN THIS STUDY

INTROVERTS								EXTRAVERTS							
CASE NO.	JUDGES					TOTAL	AVERAGE OF RATINGS	CASE NO.	JUDGES					TOTAL	AVERAGE OF RATINGS
	1	2	3	4	5				1	2	3	4	5		
1	103	95	99			297	99	1	56	62	53	51		220	55
2	102	95	88	109		394	98.5	2	58	51	53	69		231	57.75
3	106	106	111			323	107.7	3	38	45	52	56		191	47.75
4	105	95	94			294	98	4	61	50	67	71		249	62.75
5	101	106	107	107		421	105.25	5	55	39	40	54	52	240	48
6	110	106	97			313	104.3	6	77	32	53	41		203	50.75
7	104	89	105	103		401	100.25	7	69	65	54	75		263	65.75
8	95	88	97			280	93.3	8	60	84	44	65		253	63.25
9	99	92	88			279	93	9	62	26	29	60		233	58.25
10	103	101	87	103		394	98.5	10	56	56	42	59		213	53.25
11	99	93	89			281	93.7	11	52	55	93			200	66.7
12	113	92	101			306	102	12	51	43	43	58	37	232	46.4
13	107	106	103	88		404	101	13	36	40	69			145	48.3
14	103	88	116			307	102.3	14	55	29	41			125	41.7
15	95	92	90			277	92.3	15	57	66	60			183	61
16	100	91	91			282	94	16	42	29	39	45	39	194	38.8
17	99	97	87			283	94.3	17	59	59	50			168	56
18	106	93	97			296	98.7	18	41	32	43	53		174	43.5
19	98	100	101			299	99.7	19	71	61	55	73		260	65
20	94	108	97			299	99.7	20	82	49	29	40		200	50
21	91	93	117			301	100.3	21	40	36	38	29		143	35.75
22	111	99	104			314	104.7	22	52	41	63	37		193	48.25
23	113	93	93	89		388	97	23	71	52	73	60		256	64
24	98	85	93			276	92	24	44	53	65	49		211	52.75
25	105	87	86	107		385	96.25	25	69	61	59			189	63
26	99	99	95			293	97.7	26	45	78	35			158	52.8
27	94	112	101			307	102.3	27	69	65	61			195	65
28	87	90	94			271	90.3	28	35	43	34	54		166	41.5
29	94	103	90			287	95.7	29	49	35	47	30		161	40.25
30	101	98	109			308	102.7	30	28	26	56	67		177	44.25
31	82	101	99	102		384	96	31	77	68	46	77		268	67
32	102	89	100			291	97	32	29	28	59			116	38.7
33	103	89	88	100		380	95	33	38	29	41	53		161	40.25
34	107	79	105			291	97	34	42	67	72			181	60.3
35	91	97	107			295	98.3	35	64	93	50	49		256	64
36	89	96	103	75		363	90.75	36	39	60	65	40		204	51
37	100	96	107			303	101	37	51	66	54	56		221	56.75
38	91	96	97	95		379	94.75	38	37	43	40	56		176	44
39	109	106	99			314	104.7	39	41	86	58			185	61.7
40	102	97	97	68		364	91	40	53	57	46	55		211	52.75
41	95	108	95	83		381	95.25	41	40	46	32	43		161	40.25
42	99	108	97	96		400	100	42	58	69	66	66		259	64.75
43	112	97	45	92		346	86.5	43	56	36	62	55		209	52.25
44	99	92	99			290	96.7	44	48	71	57	57		233	58.25
45	96	84	98			278	92.7	45	43	38	44	36		161	40.25

TABLE IV (*Continued*)

Introverts								Extraverts							
Case No.	Judges					Total	Average of Ratings	Case No.	Judges					Total	Average of Ratings
	1	2	3	4	5				1	2	3	4	5		
46	106	72	108	109		395	98.75	46	39	35	57	56		187	46.75
47	78	104	94	91		367	91.75	47	43	62	57	74		236	59
48	85	80	106	102		373	93.25	48	62	47	33	56		198	48.5
49	104	105	102			311	103.7	49	71	41	63	35		210	52.5
50	99	105	102			306	102	50	30	35	47	50		162	40.5
51	102	95	94			291	97	51	71	72	53	56		252	63
52	81	100	91			272	90.7	52	51	59	33			143	47.7
53	88	87	111			286	95.3	53	37	63	54			154	51.3
54	86	108	98			292	97.3	54	61	34	44			139	46.3
55	94	99	83			276	92	55	68	42	58	60		228	57
56	107	87	80			274	91.3	56	52	44	44			140	46.7
57	105	97	90			292	97.3	57	41	62	64	49		246	61.5
58	104	94	101			299	99.7	58	48	50	46	50		194	48.5
59	99	106	96			301	100.3	59	67	53	41	73		234	58.5
60	94	97	98			289	96.3	60	41	49	58	55		203	50.75
61	100	98	112			310	103.3	61	81	68	35	67		251	62.75
62	85	91	113			289	96.3	62	47	34	60	33		174	43.5
63	97	99	106			302	100.7	63	42	42	52	43		179	44.75
64	92	92	106			290	96.7	64	55	49	55	54		213	53.25
65	93	101	103			297	99	65	57	52	34	74		217	54.25
66	90	96	107			293	97.7	66	50	48	51	67		216	54
67	88	105	93			286	95.3	67	57	53	48	60		218	54.5
68	99	101	104			304	101.3	68	69	34	57			160	53.5
69	106	93	99			298	99.3	69	75	64	61	62		262	65.5
70	101	92	98			291	97	70	52	70	42	59		223	55.75
71	98	102	93			293	97.7	71	46	43	51	63		203	50.75
72	97	89	89			275	91.7	72	40	31	37	56		164	41
73	100	105	102			307	102.3	73	52	34	60			146	48.7
74	103	87	102			292	97.3	74	48	70	35	70		223	56
75	99	109	105			313	104.3	75	65	51	66	63		245	61.25
76	108	106	87			301	100.3	76	51	63	52	41		207	51.75
77	93	109	97			299	99.7	77	55	49	57			161	53.7
78	101	87	106	107		401	100.25	78	42	60	64	53		219	54.75
79	98	101	33			282	94	79	42	47	48	60		197	49.25
80	96	91	82	84		353	88.25	80	35	45	66	57		203	50.75
81	111	86	95			292	97.3	81	34	54	56	57		201	59.25
82	113	102	104			319	106.3	82	33	34	44	62		173	43.25
83	104	83	103	108		398	99.5	83	42	47	47			136	45.3
84	98	89	93			280	93.3	84	31	31	45	59		166	41.5
85	91	86	121	115	63	475	95.2	85	49	55	60	79		243	60.75
86	105	113	94	91		403	100.75	86	57	63	65			185	61.66
87	115	101	109			325	108.3	87	49	49	49	50		197	49.24
88	91	89	99			279	93	88	51	52	57	62		222	55.5
89	105	83	69	82		339	84.75	89	49	56	90			195	65
90	89	98	113			300	100	90	53	59	75	80		267	66.75

TABLE IV (*Continued*)

Introverts								Extraverts							
Case No.	Judges					Total	Average of Ratings	Case No.	Judges					Total	Average of Ratings
	1	2	3	4	5				1	2	3	4	5		
91	92	102	114			308	102.7	91	44	54	33			131	43.6
92	103	98	86			287	55.7	92	36	61	70	44		211	52.75
93	100	82	110			292	97.3	93	41	47	44			132	44
94	85	84	93	93		355	88.75	94	54	48	53	42		207	51.75
95	108	102	103			313	104.3	95	58	49	66			173	57.7
96	90	86	106	106	98	486	97.2	96	44	31	50	30		155	38.75
97	98	90	105			293	97.7	97	47	68	59	68		242	60.5
98	93	95	95			283	94.3	98	61	51	55			167	55.7
99	98	105	106			309	103	99	35	31	34	41		191	47.74
100	87	104	107			298	99.3	100	53	34	44	54		185	56.25
101	109	112	111			332	110.7	101	48	34	45			127	42.3
102	105	114	96			315	105	102	35	51	67	79		232	58
103	93	98	107			298	99.3	103	56	62	28			146	48.7

tional Measurement. The total number of different judges who coöperated in giving the ratings here used was 269, and the average number of ratings given by each judge was 2.72.

It will be noted that in a few cases the judges disagreed in their ratings. All cases which were retained in spite of the disagreement of judges were retained because of a characteristic behavior record. Introvert 43 is a case in point. But no other case was retained in either group unless at least three judges agreed, and unless the average rating of all the judges classed the case as introvert or extravert.

The Reliability of the Ratings

The method used in selecting judges made it impossible to establish valid intercorrelations between the ratings of any two judges, since no judges rated enough children in common to make such a study feasible. The judges did, however, in every case, save introvert 43, all agree in rating each child as definitely introvert or extravert, no matter how much they disagreed with reference to the degree in which the tendency was present. Marston in his study found that the average correlation of the ratings of two judges was .71 whenever any two judges rated enough children in common to justify such a study. Similar correlations are reported by Chassell [32], Voelker [33], Cady

[34], and Caldwell and Wellman [35]. There is no reason to believe that the correlations in this study would be found smaller, if any two judges had rated a sufficiently large number of children in common to furnish a similar basis for comparison.

To determine the self-correlation of the ratings, each of the ratings used in the study was divided into two parts, twelve items in the first and thirteen in the second. The correlation between the two halves of the ratings so treated was found to be .937 ± P.E. .003, which again compares favorably with Marston's self-correlation of .89, that is, the judges were consistent with themselves to a marked degree. They were somewhat less so with each other—a state of affairs not unknown in human affairs even apart from rating scales. We conclude with Marston, therefore, that the correlation of .937 between the two halves of the scale points toward the reliability of the scale, while the practical agreement between the ratings of the different judges points toward fair reliability of the judges when both of the contrasted groups are thought of as a dichotomy superimposed on a normal frequency distribution.

Distribution of Ratings

Table V presents the distribution of the average ratings for the introverts, the extraverts, and for the two groups combined into one. The distribution is, of course, distinctly dichotomous, and each group tends definitely to show a central tendency near the middle of that part of the scale upon which it falls. Measures of central tendency and variability are shown in Plate I.

The data of Table V are interpreted in Plate I. From the nature of the scores considered, the difference between the means of the two contrasted series is so great as to exceed all likelihood of error due to errors of sampling. There is no overlapping of scores, since all scores were rejected which were not markedly characteristic of either introversion or extraversion. It is worthy of note in passing that the sigma of the scores of the extraverts is nearly twice as large as that of the scores of the introverts.

The difference between the means is so large as to establish without question the fact that in the minds of the coöperating judges there are children of secondary school age whose reactions to social situations are so divergent as to justify the assumption that extraversion and introversion constitute a dichotomy im-

TABLE V

THE FREQUENCY DISTRIBUTION OF THE AVERAGES OF JUDGES' CRITERION RATINGS

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Average Ratings			
35– 36	0	1	1
37– 38	0	0	0
39– 40	0	3	3
41– 42	0	9	9
43– 44	0	6	6
45– 46	0	4	4
47– 48	0	9	9
49– 50	0	9	9
51– 52	0	9	9
53– 54	0	11	11
55– 56	0	9	9
57– 58	0	5	5
59– 60	0	4	4
61– 62	0	8	8
63– 64	0	7	7
65– 66	0	6	6
67– 68	0	3	3
85– 86	1	0	1
87– 88	1	0	1
89– 90	2	0	2
91– 92	9	0	9
93– 94	10	0	10
95– 96	11	0	11
97– 98	21	0	21
99–100	17	0	17
101–102	12	0	12
103–104	8	0	8
105–106	7	0	7
107–108	2	0	2
109–110	1	0	1
111–112	1	0	1

PLATE I

A Comparison of the Average of the Ratings Given to A Group of 103 Introverts on the Criterion with the Corresponding Ratings Given To A Group of 103 Extraverts on the Same Criterion

I. The Measures of Central Tendency and of Variability*

	Introverts	*Extraverts*
MEDIAN	97.67	54.27
MEAN	97.72	52.44
σ distribution	4.8098	8.0097
σ mean	.4739	.7892

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 45.2816
σ difference	= .9206
Experimental Coefficient	= 49.1885
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 100%
σ overlap	= 0
Experimental Coefficient	= Practically *Infinity*
Q	= Practically 0 in 1,000

* The measures of central tendency throughout this study are based on the assumption that the beginning point of a class interval is always just above the point indicated as the upper limit of the preceding interval; e.g., 35–36 means measures exceeding 34 and not exceeding 36.

posed on a normal curve of social adjustment trends. The introvert is pictured as making these adjustments with difficulty, while the extravert makes them with striking ease. The great mass of humanity may be assumed to lie somewhere between the extreme deviations pictured here.

CHAPTER III

AGE AND INTROVERSION-EXTRAVERSION

Physiological and anatomical maturity may be thought of as having a direct bearing on the behavior patterns of human beings. Does age affect introversion-extraversion, or do the conditions noted in the preceding chapter exist without reference to age? A study of the relationship existing between age and criterion ratings should prove illuminating.

The Actual Ages of the Subjects

For the purpose of simplifying computation whenever age is one of the factors being studied, age in this study is expressed in terms of months above the basic age of twelve years. Table VI presents the actual ages of each member of each pair of cases expressed as noted above. Every effort was made to make the age difference between the members of each pair as small as possible. In no case was the difference so large as to produce significant differences in functional maturity. Subjects were finally selected only after conference with a competent judge, if the age difference was more than six months.

In Table VI, a difference is defined as plus if in a given pair of subjects the age of the extravert is greater than that of his introvert mate. It is defined as minus if the age of the extravert is smaller than that of his introvert mate. In fifty-five cases, the difference is plus; in thirty-four cases, it is minus; and in fourteen cases, there is no difference.

The average difference in the ages was but 3.58 months, a difference in functional maturity and social adjustment which is probably not large enough to affect the results of our study to any marked degree.

In both of the cities from which the cases here studied were taken, a relatively high percentage of children attend the secondary schools, far more so than in the large eastern industrial

TABLE VI

THE ACTUAL AGES OF 103 PAIRS OF INTROVERT AND EXTRAVERT SUBJECTS IN MONTHS ABOVE AGE TWELVE AND THE DIFFERENCE BETWEEN THE AGES IN EACH PAIR OF CASES, ALSO IN MONTHS

CASE NO.	INTROVERT	EXTRAVERT	DIFFERENCE	CASE NO.	INTROVERT	EXTRAVERT	DIFFERENCE	CASE NO.	INTROVERT	EXTRAVERT	DIFFERENCE
1	60	56	−4	36 ...	42	42	0	71 ...	44	44	0
2	56	57	1	37 ...	64	64	0	72 ...	27	22	−5
3	43	45	2	38 ...	61	56	−5	73 ...	17	20	3
4	68	67	−1	39 ...	57	64	7	74 ...	42	38	−4
5	62	58	−4	40 ...	64	71	7	75 ...	51	58	7
6	52	61	9	41 ...	41	41	0	76 ...	38	42	4
7	74	67	−7	42 ...	41	41	0	77 ...	43	52	9
8	54	51	−3	43 ...	69	58	−11	78 ...	37	35	−2
9	67	64	−3	44 ...	42	40	−2	79 ...	26	25	−1
10	53	55	2	45 ...	37	27	−10	80 ...	29	36	7
11	49	43	−6	46 ...	50	43	−7	81 ...	32	32	0
12	40	40	0	47 ...	63	57	−6	82 ...	43	41	−2
13	42	51	9	48 ...	61	53	−8	83 ...	23	25	2
14	61	51	−10	49 ...	63	66	3	84 ...	21	27	6
15	43	46	3	50 ...	37	31	−6	85 ...	31	28	−3
16	78	81	3	51 ...	30	32	2	86 ...	48	50	2
17	45	45	0	52 ...	43	46	3	87 ...	6	6	0
18	55	49	−6	53 ...	35	38	3	88 ...	26	22	−4
19	40	39	−1	54 ...	45	40	−5	89 ...	24	26	2
20	31	39	8	55 ...	48	48	0	90 ...	50	43	−7
21	68	65	−3	56 ...	20	27	7	91 ...	37	30	−7
22	42	41	−1	57 ...	12	12	0	92 ...	39	32	−7
23	28	28	0	58 ...	51	45	−6	93 ...	33	29	−4
24	46	48	2	59 ...	45	44	−1	94 ...	34	36	2
25	69	68	−1	60 ...	16	21	5	95 ...	33	32	−1
26	47	49	2	61 ...	52	46	−6	96 ...	29	28	−1
27	43	45	2	62 ...	40	37	−3	97 ...	30	31	1
28	51	48	−3	63 ...	24	24	0	98 ...	78	70	−8
29	66	62	−4	64 ...	7	12	5	99 ...	39	39	0
30	45	43	−2	65 ...	14	11	−3	100 ...	66	65	−1
31	47	46	−1	66 ...	24	16	−8	101 ...	27	28	1
32	57	56	−1	67 ...	23	21	−2	102 ...	55	58	3
33	48	43	−5	68 ...	48	45	−3	103 ...	14	18	4
34	45	43	−2	69 ...	28	21	−7				
35	70	66	−4	70 ...	41	38	−3				

centers. Save for the selective effect of grade progress, therefore, the groups selected for study may be thought of as a reasonably random sampling of the ages which they represent. The various age groups are small, however, and this factor may to some extent distort the sampling by the introduction of purely adventitious factors which possibly have escaped observation.

The Distribution of Ages

Table VII presents the ages in the form of frequency distributions, and Plate II shows central tendencies and the relationships of these ages to criterion ratings.

A study of Table VII and of Plate II shows the following facts:

a. The mean ages of the groups differ by only .7864 months. The groups as groups, therefore, are comparable since the difference between the two means is only .3588 times its standard

TABLE VII

The Frequency Distribution of Age Expressed in Months Above Age Twelve

Scale	Introverts	Extraverts	Combined
Months Above 12 Years:			
4– 6	1	1	2
7– 9	1	..	1
10–12	1	3	4
13–15	2	..	2
16–18	2	2	4
19–21	2	4	6
22–24	5	3	8
25–27	4	6	10
28–30	6	6	12
31–33	4	6	10
34–36	3	3	6
37–39	7	7	14
40–42	11	9	20
43–45	12	13	25
46–48	7	7	14
49–51	6	6	12
52–54	4	2	6
55–57	5	6	11
58–60	1	4	5
61–63	6	2	8
64–66	4	7	11
67–69	5	3	8
70–72	1	2	3
73–75	1	..	1
76–78	2	..	2
79–81	..	1	1

PLATE II

A Comparison of the Ages of a Group of 103 Introverts With the Ages of a Group of 103 Extraverts

I. The Measures of Central Tendency* and of Variability

	Introverts	*Extraverts*
median	42.625	42.346
mean	42.685	41.898
σ distrib.	15.952	15.506
σ mean	1.572	1.528

II. The Measure of Difference and its Reliability

Difference between the Mean Ages	= .786
σ difference	= 2.192
Experimental Coefficient	= .3588
Q	= 360 in 1,000

III. The Measure of Overlapping and its Reliability

Proportion of Ages of Introverts Which Equals or Exceeds the Median Age of the Extraverts.	= 51.08%
σ overlap	= .1497
Experimental Coefficient	= .0721
Q	= 472 in 1,000

* See footnote to Plate I on page 27.

error; i.e., by the operation of chance alone a difference as great as this or greater might be expected only 640 times out of 1,000 if other similar groups were assembled.

b. The overlap, which in this study always means the percentage of introverts that equals or exceeds the median score of the extraverts is 51.08 per cent with a standard error of .1497. The chances are 472 in 1,000 that the overlap will, on assembly of other groups of similar cases, be nearer 50 per cent than it is in the groups here studied.

c. An examination of the mean ages shows that the age excess is slightly on the side of the introvert members of the group. Especially among the cases found in the four junior high schools was there a slight tendency for the introvert cases to be somewhat older than the corresponding extravert mates. Much of the difficulty of pairing was due to the fact that the introvert cases tended slightly to over-ageness, while the extravert cases did not show this trend in so marked a degree. In 55 out of the

103 pairs, the introvert member is older than the extravert. The average age excess, however, is nearly the same for the extraverts as for introverts.

The age range was restricted to the period from twelve to nineteen because this period probably covers the range of the most active adolescent stresses, and it was thought that behavior during this period would most certainly be affected by introvert-extravert trend if such were actually present. There was, furthermore, evidence at hand that with the onset of adolescence the responses to the word association test change markedly both as to speed and kind [36]. Since the word association test was to be used in this study, it was thought best to restrict the age range as noted above.

Correlation of Age and Criterion

For the introvert group, the Pearson coefficient of correlation between age and criterion ratings is .013 ± .066. The corresponding correlation for the extravert group is .125 ± .065.

When both groups were to be considered together, the Biserial coefficient of correlation was used, because of the markedly dichotomous character of the criterion scores. Biserial r is .031 ± .087.

The correlations between criterion ratings and age are so small as to be probably due to chance, *whether we consider the contrasted groups separately or in combination.* If introversion-extraversion is a matter of a definite *Einstellung* which is gradually assumed during adolescence, then there ought to be some substantial correlation between the ages here studied and the criterion. The introvert would be expected to become more markedly introverted as he approached maturity, and the extravert would be thought of as becoming more strikingly extraverted as he became older. Such does not appear to be the case with the groups here considered.

We may conclude, therefore, that within the limits of the ages considered in this study, introversion-extraversion, in so far as it exists at all, exists quite without reference to chronological age.

CHAPTER IV

INTELLIGENCE AND INTROVERSION-EXTRAVERSION

The administration of the Stanford Binet test or of any other individual intelligence test was for various reasons impracticable. It was decided, therefore, to administer the Multimental Scale [28], Elementary School Form 1, as a group test in each school to all the children selected for this study. The children in question were assembled during the school session in each school after all the individual tests had been given, for the purpose of taking this test.

The Multimental Test was selected because it seemed to offer promise not only of serving as a measure of intelligence, but because it would serve also as a measure of alert mental nimbleness. Any tendency toward stereotypy and perseveration or indecision would be likely to be brought to light. The results justified the choice.

The form of the test used proved adequate to cover the entire range of ability presented by our group.

Table VIII presents in the form of T scores the mental test ratings of the 103 pairs of cases included in this study together with the difference between the ratings of the mates of each pair. Whenever the extravert member of a pair of subjects has a larger score than his introvert mate the difference is considered as plus although no plus sign appears in the table. Whenever the situation is reversed the difference is considered as minus. Plus differences result for sixty-nine pairs, thirty-one pairs show minus differences, and three pairs have a zero difference.

Distribution of Intelligence Scores

Table IX presents the frequency distribution of the T scores for both the introvert and the extravert group, and also for the two groups combined into one.

TABLE VIII

THE MULTIMENTAL T SCORES OF THE 103 INTROVERT-EXTRAVERT PAIRS* INCLUDED IN THIS STUDY

CASE NO.	INTROVERT	EXTRAVERT	DIFFERENCE	CASE NO.	INTROVERT	EXTRAVERT	DIFFERENCE	CASE NO.	INTROVERT	EXTRAVERT	DIFFERENCE
1	54	72	18	36 ...	61	68	7	71 ...	49	60	11
2	62	70	8	37 ...	72	69	−3	72 ...	56	56	0
3	64	69	5	38 ...	56	65	9	73 ...	53	61	8
4	46	63	17	39 ...	62	47	−15	74 ...	59	64	5
5	67	63	−4	40 ...	63	54	−9	75....	56	58	2
6	66	63	−3	41 ...	64	66	2	76 ...	61	52	−9
7	49	58	9	42 ...	58	74	16	77 ...	53	63	10
8	53	60	7	43 ...	58	57	−1	78 ...	55	52	−3
9	62	63	1	44 ...	54	53	−1	79 ...	67	74	7
10	53	73	20	45 ...	69	62	−7	80 ...	59	59	0
11	53	68	15	46 ...	62	75	13	81 ...	49	70	21
12	61	73	12	47 ...	49	57	8	82 ...	60	64	4
13	54	58	4	48 ...	59	66	7	83 ...	58	60	2
14	68	71	3	49 ...	55	58	3	84 ...	65	56	−9
15	60	68	8	50 ...	58	60	2	85 ...	52	68	16
16	62	58	−4	51 ...	68	57	−11	86 ...	57	40	−17
17	58	68	10	52 ...	57	65	8	87 ...	61	78	17
18	70	68	−2	53 ...	54	49	−5	88 ...	65	71	6
19	67	63	−4	54 ...	54	62	8	89 ...	71	51	−20
20	58	67	9	55 ...	46	44	−2	90 ...	45	54	9
21	64	61	−3	56 ...	35	51	16	91 ...	64	78	14
22	59	54	−5	57 ...	55	72	17	92 ...	53	54	1
23	90	63	−27	58 ...	53	51	−2	93 ...	58	67	−11
24	60	72	12	59 ...	40	59	19	94 ...	66	59	−7
25	71	75	4	60 ...	54	61	7	95 ...	54	60	6
26	64	73	9	61 ...	60	62	2	96 ...	61	58	−3
27	58	70	12	62 ...	50	54	4	97 ...	50	72	22
28	59	80	21	63 ...	40	54	14	98 ...	52	59	7
29	51	51	0	64 ...	37	56	19	99 ...	64	65	1
30	54	67	13	65 ...	55	59	4	100 ...	57	48	−9
31	68	64	−4	66 ...	46	58	12	101 ...	47	59	12
32	56	73	17	67 ...	50	57	7	102 ...	44	47	3
33	54	58	4	68 ...	51	75	24	103 ...	69	59	−10
34	63	66	3	69 ...	55	51	−4				
35	63	71	8	70 ...	54	49	−5				

* The extravert group is undoubtedly somewhat brighter than the introvert group, in so far as the Multimental Test measures brightness. The differences are definitely in favor of the extraverts both as to frequency and size.

Reference to this table and to Plates II and III will show the relationship between the central tendencies of the mental and chronological ages of both groups.

The data of Table IX and of Plate III suggest the following remarks.

a. The distribution of T scores in the case of both the introvert and the extravert groups approaches a normal distribution.

b. The variability of the T scores of the introverts measured in terms of the standard deviation of the scores of the extraverts is .986. The variability of the two distributions is substantially the same.

c. The mean intelligence rating of the introvert group is 4.544 T scores smaller than that of the extravert group. The experimental coefficient of this difference is 3.99, so large as to make it highly improbable that the difference is due to chance errors of selection.

d. The percentage of intelligence scores of introverts which equal or exceed the median intelligence T score of the extraverts is 34.14 per cent. If the two groups were of equal "intelligence," the overlap would be 50 per cent. The standard error of the overlap is .1552, indicating 154 chances in 1,000 that such a

TABLE IX

THE FREQUENCY DISTRIBUTION OF MULTIMENTAL T SCORES

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
T Scores			
34–36	1	..	1
37–39	1	..	1
40–42	2	1	3
43–45	2	1	3
46–48	4	3	7
49–51	9	7	16
52–54	19	9	28
55–57	12	7	19
58–60	17	20	37
61–63	13	13	26
64–66	10	9	19
67–69	8	11	19
70–72	4	10	14
73–75	..	9	9
76–78	..	2	2
79–81	..	1	1
82–84	..	..	..
85–87	..	..	..
88–90	1	..	1

difference of overlap is due to an error of sampling rather than to a real difference in native ability.

PLATE III

A Comparison of the Scores Made by a Group of 103 Introverts on the Multimental Test (Using T Scores) With the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency* and of Variability

	Introverts	*Extraverts*
median	52.265	60.808
mean	56.84–	61.384
σ distrib.	8.117	8.223
σ mean	.7997	.8103

II. The Measure of Difference and its Reliability

Difference between the Mean Scores	= 4.5437
σ difference	= 1.1384
Experimental Coefficient	= 3.991
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and its Reliability

Proportion of Scores of Introverts which Equals or Exceeds the Median Score of the Extraverts	= 34.14%
σ overlap	= .1552
Experimental Coefficient	= 1.022
Q	= 154 in 1,000

* See footnote to Plate I on page 27.

Correlations of Intelligence and Criterion Ratings

The correlation between intelligence scores and criterion ratings was calculated separately by the Pearson Product-Moments method for each of the contrasted groups and by the Biserial r method for the two groups combined. The results were as follows:

r of intelligence and criterion:

Introvert group, $r = -.086 \pm .066$
Extravert group, $r = .038 \pm .066$
Combined group, Biserial $r = -.339 \pm .054$

r of intelligence and age:

Introvert group, $r = .086 \pm .066$
Extravert group, $r = -.12 \pm .066$
Combined group, Biserial $r = .031 \pm .047$

The correlation [1] of intelligence scores and criterion ratings approaches zero when the groups are considered separately. The biserial r of —.339 found when the groups are combined is due to the superiority of the extraverts as a group, for reasons which will be discussed later.

The absence of any significant correlation between age and intelligence was to be expected. In age selected school groups, a zero or even moderately negative correlation would be expected because of the selective effect of school progress.

Conclusions

From the preceding considerations, we may conclude that there is a significant difference between the intelligence test scores of our two contrasted groups. This difference, however, exists in only modest amount and may be due to conditioned modes of attack and specialized work habits which seem to characterize introverts and extraverts as groups. The nature of the schizoid and cycloid behavior patterns on the basis of which the teacher-judges made the original selection of our cases would tend to produce two groups with precisely such contrasting work habits.

The difference in aggressive approach which is suggested above was evident in the daily work of both of the groups. Careful examination of the test papers handed in by the subjects of this study showed clearly the evidences of haste, of eager press to action, of intellectual daring, of readiness to "try anything once" which characterize the attack of the extraverts, while the records of the introverts are replete with evidences of hesitation, of unwillingness to "take a chance," with consequent heavy penalty for problems not attempted, because by the time decisions had been reached, the time available had gone, and the test was over. Such data as are available with reference to omissions, erasures, and other signs of hesitation, inhibition or haste are presented below.[2] It seems plausible to say that at least some part of the

[1] The partial correlation of criterion with intelligence with age held constant is not here reported because of limitations of space. All partial correlations were small, and interesting only for that reason.

[2] A careful examination of the Multimental Test records shows the following differences:

	Introverts	Extraverts	Ratio
Number of Erasures or Changes Made on Test Blank	369	472	.782
Number of Items Not Attempted at All.....	632	279	2.265

An unwillingness to "take a chance" in a mental test, while it may reduce the total number of errors, will leave unattempted an unduly large part of the total assigned task whenever there is a time limit set.

ability difference that has been noted above may be the result, not of actual ability differences, but of differences in *Einstellung* and of work habit. Goddard and Mateer have called attention to the fact that the I.Q. is not always a reliable measure of real native ability. The "unstable child" often appears to disadvantage when measured by this standard alone. Marked introversion and possibly extraversion, as found in this study, may coincide at some points with Mateer's "psychopathy."

That there was an undoubted difference in the dynamic energy displayed by the two groups was noted by all the testers. It seemed to be especially marked whenever the subjects worked under a speeded social situation. The teachers of one of the junior high schools suggested that the introvert group contained many slow children, timid, apathetic, unresponsive, while the extravert group contained some of the most delightful children in the school. The principal of one of the senior high schools pictured the extravert group as containing the most popular people in school, alert, ready to enter into any activity. Some of them were delightful people, but they often tended to be in "hot water." The introvert group was thought of as a diffident, backward group. Both groups were within the limits of the belt of normality [I.Q's from 90 to 110] since the average I.Q. of the introverts was 92.4, while that of the extraverts was 102.5.

From these considerations, it would appear then as though either the extraverts as a group are actually somewhat more intelligent than the introverts as a group, or that the extraverts possess in larger degree the factor of élan, of dynamic urge, of available energy, of mobility, which possibly forms a significant part in every intelligence test situation in which a time limit is a factor. The data at hand do not permit a final answer. Certainly within the groups here considered, intelligence does not tend to keep step with the criterion rating.

CHAPTER V

THE FREE ASSOCIATION TEST AND INTROVERSION-EXTRAVERSION

Earlier Uses of the Test

The association test has a long record of usefulness as an instrument for psycho-diagnosis. Kraepelin, Aschaffenburg, and Ziehen applied it in their clinical work and ranked it among the promising procedures in psycho-diagnosis. Jung [25], in conjunction with a group of other workers, conducted an extensive series of investigations with the association test. Particular stress was laid on the so-called "diagnostic signs." In consequence of these studies, Jung concluded that the association test had definite value as a diagnostic device in distinguishing between "subjective" and "objective" persons. Subjective persons were thought of as not easily distractible. They respond in terms of predicates and take the test much to heart, while objective persons are easily distractible, respond with "superficial" reactions, and are not deeply concerned in the process.

Lippman [37] whose primary interest lay in the field of *Tatbestanddiagnostik* reaches conclusions in essential agreement with those of Jung in the matter of the reliability of symptom signs, and also offers an explanation of the associational ramifications, blockings, and facilitations which bring these telltale signs into being.

About the same time, Wells [38, 39, 40, 41] began a series of studies with the word association test, and reached substantially the conclusions which Jung and his group had reached. There were found two types of subjects: one egocentric, subjective, with predicate responses, and the other objective, allocentric, with superficial responses. Wells [42] has recently written an exhaustive survey of the free association experiment and of its clinical uses.

The study of Kent and Rosanoff [43] on association in insanity concerned itself with frequency and quality of response

primarily and did not directly take account of "complex signs" in the sense above referred to, except as perseveration, neologisms, repetition of stimulus word, failure of response and other symptoms are noted as significant. They were concerned primarily with the frequency of responses. Other workers, however, who have used the Kent-Rosanoff series call attention to the significance of "complex signs." Mateer [44], working under the direction of Goddard, thinks they are "at least as important as the reaction word," and discusses these incidental by-products of the association experiments under the head of "association quality."

Approaching the question of the validity of complex signs more specifically from the experimental angle, McClatchy and Cooper [45] administered a free association test to sixty sophomores of the University of Texas, and found a correlation of .81 with social conformity, which was measured by the sum of the frequencies of the responses. They conclude that long reaction times may be due to paucity of ideas, while short reaction times point toward good school conformity and high intelligence. They note, however, that markedly frequent short reaction time seems to indicate a trend toward stereotypy.

Hull and Lugoff [46] studied the reliability of so-called complex signs by giving Jung's one-hundred-word list to fifty men and fifty women. They reach the conclusion that the first four of the following five diagnostic signs undoubtedly have significance: (1) Repetition of the stimulus word, (2) assimilation or misunderstanding of the stimulus word, (3) long reaction time, (4) defective reproduction (5) repeated use of the same reaction word. They find a correlation of .69 and .52, respectively, between the third of these signs and the first, and between the third and the second.

Hubbard [47], continuing the work of Hull and Lugoff, studied the perseveration of the complex signs. By writing the original one hundred words of the test list on round tags, and shaking these tags together, she constructs fifty lists in each of which the position of the one hundred words is determined by pure chance. She concludes that long reaction times have more significance near the beginning and end of the test than in the middle. She finds some tendency toward sign perseveration. The experiment, however, is affected by the fact that the test after the first time

provokes an *Einstellung* which makes the reaction time hardly comparable after the first test.

From these and other studies, it appears that among "signs," which have been selected as "indicators," the following are significant: (1) lengthened reaction time, (2) failure of response, (3) failure of correct reproduction, (4) responding to a word by its opposite, (5) repetition of the stimulus word, and (6) stereotypy or perseveration in response. It seemed possible that if "complex indicators" were at all significant, they might be of service in the study of introversion-extraversion.

The Test Described

A list of one hundred common words containing forty nouns, forty adjectives, and twenty verbs was constructed on the basis of twelve earlier lists. It was imperative that the words be so chosen as to be within the comprehension of the subjects likely to be found. Neither the Kent-Rosanoff nor the Jung list had proven entirely satisfactory. The parts of speech were balanced in order to make possible some study of the possible difference in response evoked by each kind of word. The directions were carefully followed. Time was taken with a stop watch and both response and time were recorded. After completing the first presentation of the test, it was immediately given a second time, for the purpose of securing a reproduction list of responses. This second list of responses was taken without the use of the stop watch and is referred to as "reproductions."

Table X shows the list of stimulus words used in the exact order in which they were given.

Directions for Free Association Test

The following directions were followed verbatim:

Request your subject to seat himself comfortably, facing you. See that no other persons are in the room with you, nor in line of vision. Exclude as far as possible all outside stimuli. If possible have subject face a blank wall. If anyone enters while this test is in progress, stop at once, and begin again after interruption has ceased. Use the following form:

"Here is a list of common ordinary words. I am going to say them to you one by one, and I want you to tell me the very first word that each of them makes you think of. Don't stop to pick out a good sounding word. Just give me the very first one that comes to your mind. Let's see if you understand. I will say a word, and you tell me the first word it brings to your mind. Ready? Tree. Now another—Show."

When it is clear that your subject thoroughly understands what is wanted, proceed as follows: "I am going to start this watch each time I say a word, and stop it each time you answer me. Are you ready? Acorn."

Start the stop watch on the accented syllable of your word. Stop the watch at the first sound of your subject's response. Record the *exact* first response which your subject makes. Record the time in decimal fractional form. Record any display of affect that may occur with any word.

Proceed through the entire list of one hundred words in one sitting if you can. When you have finished the list start again at the beginning saying: "Now we will try this once more to see how well you can do it this second time. Give me the first word that comes to your mind. If it happens to be the same word that you gave me the first time so much the better. Ready? All right. Acorn."

Throughout the list, use a falling inflection on each word. Speak distinctly and reasonably loudly. If subject begins to respond with sentences or phrases, stop and ask him to use single words. Make a careful record of any behavior display which may occur while giving this test, which is not provided for above. If subject does not respond to a stimulus in twenty-five seconds count it a failure, and pass on to the next stimulus.

TABLE X

List of Words Used in the Free Association Test

1. acorn	26. chair	51. apron	76. feather
2. finger	27. organ	52. penny	77. attic
3. tell	28. find	53. forget	78. begin
4. soft	29. strong	54. tired	79. thick
5. round	30. lonely	55. angry	80. stingy
6. club	31. monkey	56. trunk	81. picture
7. banana	32. hair	57. girl	82. doctor
8. tickle	33. squeeze	58. scorch	83. wash
9. simple	34. tall	59. happy	84. foolish
10. homely	35. wise	60. perfect	85. awkward
11. button	36. tube	61. apple	86. habit
12. juice	37. milk	62. music	87. lettuce
13. start	38. handle	63. listen	88. suspect
14. hard	39. glad	64. private	89. warm
15. red	40. dark	65. green	90. proud
16. water	41. candy	66. picnic	91. knife
17. ball	42. boy	67. trick	92. thing
18. feel	43. come	68. allow	93. practice
19. yellow	44. white	69. queer	94. brave
20. crooked	45. careful	70. straight	95. gloomy
21. tool	46. mail	71. sausage	96. thumb
22. candle	47. clown	72. pillow	97. jelly
23. tremble	48. manage	73. touch	98. sharpen
24. quick	49. lazy	74. honest	99. afraid
25. noble	50. hungry	75. funny	100. equal

Discussion of Test Results

From the test records thus secured scores were calculated for seven different items. They will be presented and discussed in the following order:

1. The mean time of response.
2. The median time of response.
3. The 90 percentile time of response.
4. The number of response failures.
5. The number of reproduction failures.
6. The word range (stereotypy).
7. The number of contrast responses.

1. The mean time of response

The mean time of response was calculated by dividing the sum of the reaction times by one hundred. Each failure to respond was counted as twenty-five seconds. The data thus secured are presented in Table XI. Measures of tendency and variability are found in Plate IV.

A survey of the distributions of Table XI and of Plate IV reveals a number of significant trends:

a. Both of the mean association response time distributions are about equally skewed to the right.

b. The variability of the mean time scores of the introverts is 1.654 times that of the extravert scores. The tendency for the responses of extraverts to cluster closely about the mean of 2.64″ is definite, while the tendency of the responses of the introverts to scatter from the definitely larger mean of 3.62″ is also clearly indicated.

c. The difference between the response time means of the two contrasted groups is 6.245 times the standard error of that difference. There is therefore not one chance in 10,000 that the difference is due to a chance error of sampling. Some other factor causes it.

d. Of the introvert association responses, 87.09 per cent. of the mean time scores equal or exceed the median of the responses of the extraverts. The excess of 37.09 per cent. is so large, that it is 11.48 times its standard error, which entirely precludes the probability that the overlap is due to chance errors of selection.

TABLE XI

THE FREQUENCY DISTRIBUTION OF MEAN ASSOCIATION TIME SCORES

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Time in Seconds			
1.26– 1.50	..	1	1
1.51– 1.75	2	3	5
1.76– 2.00	3	12	15
2.01– 2.25	6	25	31
2.26– 2.50	6	17	23
2.51– 2.75	14	11	25
2.76– 3.00	10	9	19
3.01– 3.25	11	4	15
3.26– 3.50	5	6	11
3.51– 3.75	7	7	14
3.76– 4.00	10	2	12
4.01– 4.25	5	1	6
4.26– 4.50	4	2	6
4.51– 4.75	4	..	4
4.76– 5.00	3	2	5
5.01– 5.25	2	..	2
5.26– 5.50	3	..	3
5.51– 5.75	..	..	..
5.76– 6.00	4	..	4
6.01– 6.25	1	..	1
6.26– 6.50	1	..	1
6.51– 6.75	1	..	1
6.76– 7.00	..	1	1
7.01– 7.25	..	..	..
7.26– 7.50	..	..	..
7.51– 7.75	..	..	..
7.76– 8.00	..	..	..
8.01– 8.25	..	..	..
8.26– 8.50	..	..	..
8.51– 8.75	..	..	..
8.76– 9.00	..	..	..
9.01– 9.25	..	..	..
11.26–11.50	1	..	1

From Table XII on page 46, we observe the following trends:

a. The correlation between mean association response time and criterion is small but consistently positive when the two groups are considered separately. When the groups are com-

PLATE IV

A Comparison of the Mean Association Time Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	3.2386	2.404
mean	3.6265	2.6444
σ distrib.	1.3658	.8256
σ mean	.1346	.0814

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= .982
σ difference	= .1573
Experimental Coefficient	= 6.245
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 87.09%
σ overlap	= .0332
Experimental Coefficient	= 11.172
Q	= Practically 0 in 1,000

bined into one group there is a sharp increase in the correlation, approaching the ordinary correlations between school performance as checked by teachers and intelligence scores.

b. The correlations of mean association time and age are insignificant. This is somewhat surprising since it has been suggested that in early adolescence age is a function of the speed of response in the association test.

c. The correlation of intelligence with mean association time is small but consistent. In both groups high speed and low intelligence show a slight tendency to be associated. In both cases, the large probable error makes conclusions uncertain. When the two groups are combined into one, the relationship appears to be definitely negative, agreeing here with Murphy [48], who found in one hundred and nineteen psychotic cases a negative correlation of —.31 between speed of response and Stanford I.Q. The psychoses were of the manic depressive and

TABLE XII

THE CORRELATIONS BETWEEN SCORES ON MEAN ASSOCIATION TIME AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	.150 ± .065	.121 ± .065	*.62 ± .059
r_{23}	− .016 ± .066	.041 ± .066	.049 ± .047
r_{24}	− .135 ± .065	− .162 ± .065	− .274 ± .043

* Correlations preceded by an asterisk are Biserial *r* correlations. All others are Pearson Product-Moment coefficients.

dementia praecox types. The dementia praecox cases reacted more slowly, just as here the introverts tend to do likewise, when compared with their extravert mates.

From the facts above presented we may conclude, therefore, that introverts *tend definitely to react more slowly* to the conditions of the free association experiment than do their extravert mates, when speed is measured in terms of the mean time of one hundred consecutive responses.

It is equally certain that, as far as the data here collected permit of any conclusion, the relationship between response time and age is negligible, and that the relationship between intelligence and response time is nominal and opposed to that noted between the criterion and response time.

2. THE MEDIAN TIME OF RESPONSE

In view of the possible influence of extremes in reaction time on the part of a few cases, it was deemed desirable to see whether the relationship discovered in the study of the mean association time would still obtain if the median time were taken instead. Table XIII was prepared accordingly, and the facts of Plate V and Table XIV were developed from it. The data from which the median times were derived are identical with those that were used in finding the mean time, save that here there was found

for each case that point on the scale on each side of which one-half of his reaction times was found.

A study of Tables XIII and XIV and of Plate V, and a comparison with Tables XI and XII reveal a number of significant facts.

a. The form of the two contrasted distributions of Table XIII is slightly different. Both are positively skewed, but the skew of the scores of the extraverts is significantly smaller than in the case of the mean association time scores of the extraverts.

TABLE XIII

THE FREQUENCY DISTRIBUTION OF SCORES ON MEDIAN ASSOCIATION TIME

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Time in Seconds:			
1.01–1.20	..	1	1
1.21–1.40	1	2	3
1.41–1.60	2	9	11
1.61–1.80	6	18	24
1.81–2.00	14	33	47
2.01–2.20	22	16	38
2.21–2.40	9	6	15
2.41–2.60	11	7	18
2.61–2.80	5	5	10
2.81–3.00	14	3	17
3.01–3.20	3	2	5
3.21–3.40	6	..	6
3.41–3.60	3	1	4
3.61–3.80	1	..	1
3.81–4.00	4	..	4
4.01–4.20	..	..	..
4.21–4.40	..	..	..
4.41–4.60	..	..	..
4.61–4.80	..	..	..
4.81–5.00	1	..	1
5.01–5.20	..	..	..
5.21–5.40	..	..	..
5.41–5.60	..	..	..
5.61–5.80	..	..	..
5.81–6.00	..	..	..
6.01–6.20	..	..	..
6.21–6.40	..	..	..
6.41–6.60	1	..	1

PLATE V

A Comparison of the Median Association Time Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	2.31	1.930
mean	2.523	2.013
σ distrib.	.7433	.4177
σ mean	.0732	.0412

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= .5107
σ difference	= .084
Experimental Coefficient	= 6.079
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 82.41%
σ overlap	= .0374
Experimental Coefficient	= 8.666
Q	= Practically 0 in 1,000

b. The standard deviation of the median time scores of the introvert group is 1.779 times as large as that of the extravert group. The scores of the introverts are definitely more variable than are those of the extraverts.

c. The difference between the mean median time of the contrasted groups is 6.079 times its standard error. That the introverts have a longer median time of response than do the extraverts is due to some fact other than chance errors of sampling.

d. Of the introvert group, 82.41 per cent. of the median scores equal or exceed the median score of the extravert group. The excess of overlap has much less than one chance in 100,000 of being due only to errors of sampling.

From the correlations reported in Table XIV, we note that the correlations of the medians are in substantial agreement with those which were found in our study of the mean times. There is little or no trace of any correlation between age and

TABLE XIV

THE CORRELATIONS BETWEEN MEDIAN ASSOCIATION TIME SCORES AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	.082 ± .066	.157 ± .065	*.487 ± .048
r_{23}	.055 ± .066	.042 ± .066	.069 ± .047
r_{24}	− .156 ± .065	− .122 ± .066	− .227 ± .045

* Correlations marked with an asterisk are Biserial r correlations.

the median response time. Intelligence is correlated negatively, following in this the trend shown by the mean times.

A study of the median response time to the free association test reveals that within the limits of the groups here studied introverts respond more slowly to stimulus words than do extraverts, when the score is expressed as the median of one hundred consecutive responses, and that neither age nor intelligence is to be thought of as a prominent function in such median time scores as have been noted. The difference is so fundamental as to persist even when the influence of extreme measures is obliterated by using the median instead of the mean.

3. NINETY PERCENTILE TIME OF RESPONSE

An examination of the test blanks raised the question whether there was not a marked tendency for the introverts as a group to have a larger number of exaggeratedly long times than the extraverts.

The reaction times were therefore arranged on a percentile scale, and the 90 percentile times were studied as the mean and median times had been. The results are interesting and follow the trend already shown in our study of the mean and median times. Table XV shows the frequency distributions of the 90 percentile reaction times, and on Plate VI and Table XVI will be found the results of the study of these data.

From Tables XV and XVI and from Plate VI, the following facts may be gleaned:

a. The form of the two contrasted distributions of scores is somewhat positively skewed, the curve of the scores of the introverts somewhat more so than that of the extraverts.

b. The variability of the scores of the introverts is 1.64 times that of the scores of the extraverts, when variability is expressed in terms of standard deviation. We have noted the same tendency earlier when considering the mean and median reaction times.

TABLE XV

THE FREQUENCY DISTRIBUTION OF 90 PERCENTILE ASSOCIATION TIME SCORES

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
90 Percentile Time in Seconds:			
1.81– 2.00	..	1	1
2.01– 2.50	3	9	12
2.51– 3.00	6	16	22
3.01– 3.50	7	18	25
3.51– 4.00	12	17	29
4.01– 4.50	9	6	15
4.51– 5.00	7	13	20
5.01– 5.50	7	5	12
5.51– 6.00	10	3	13
6.01– 6.50	5	5	10
6.51– 7.00	5	4	9
7.01– 7.50	6	1	7
7.51– 8.00	2	..	2
8.01– 8.50	..	1	1
8.51– 9.00	4	2	6
9.01– 9.50	1	1	2
9.51–10.00	5	..	5
10.01–10.50	..	..	..
10.51–11.00	2	..	2
11.01–11.50	2	..	2
11.51–12.00	3	..	3
12.01–12.50	3	..	3
16.51–17.00	1	..	1
23.51–24.00	1	..	1
24.01–24.50	1	..	1
24.51–25.00	1	1	2

PLATE VI

A Comparison of the 90 Percentile Association Time Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Item

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	5.464	3.727
mean	6.595	4.313
σ distrib.	4.186	2.552
σ mean	.4124	.2515

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 2.868
σ difference	= .4812
Experimental Coefficient	= 5.961
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 76.98%
σ overlap	= .0436
Experimental Coefficient	= 6.188
Q	= Practically 0 in 1,000

c. The difference between the means of the 90 percentiles of the contrasted distributions is 2.868″, 5.961 times its standard error. Again, we note that the difference is considerably larger than would occur by a pure chance error of sampling.

d. The overlap of the two distributions is also characteristic of the trend already shown in the two preceding studies. Of the introverts, 76.98 per cent have scores which equal or exceed the median score of the extraverts. Had the overlap been due to chance alone, it would have been 50 per cent. The standard error of the overlap is .0436, which when reduced to terms of chance means that there is less than 1 chance in 10,000 that the overlap is due to the error of sampling alone.

e. The correlations noted in Table XVI are in substantial agreement with those that were found in connection with the study of the correlations of mean and median times. The correlations of the scores of the separate groups with the criterion

TABLE XVI

THE CORRELATIONS BETWEEN SCORES ON 90 PERCENTILE ASSOCIATION TIME AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	.133 ± .065	.047 ± .066	*.494 ± .058
r_{23}	.063 ± .066	.028 ± .067	.070 ± .047
r_{24}	− .069 ± .066	− .121 ± .065	− .194 ± .045

* Correlations marked by an asterisk are Biserial r correlations.

are small, probably in part attenuated by the narrow range of the scale section, and by the nature of all judgment scores.

f. Neither age nor intelligence show any convincing correlation with 90 percentile time scores. Such correlation as exists with intelligence is negative, therein agreeing in substance with Murphy [48] and with McClatchy and Cooper [45], both of whom found negative relationship between intelligence and reaction time.

There is a definite and real difference between the 90 percentile reaction times of introverts and extraverts, quite apart from chance errors of sampling, and neither age nor intelligence is a large function of the relationship which exists between 90 percentile scores and a tendency toward introversion or extraversion.

Summary of the Study of Reaction Time

1. The means of the three measures of reaction time show a consistent tendency for the time of the introvert group to be longer than that of the extravert group.

	INTROVERTS	EXTRAVERTS	DIFFERENCE	RATIO*
Mean Reaction Time	3.6265″	2.6444″	.9820″	1.3713
Median Reaction Time	2.5233″	2.0126″	.5107″	1.2537
90 Percentile Reaction Time	6.5947″	4.3131″	2.8621″	1.5289

* "Ratio" is to be interpreted as the central tendency of the introverts divided by the corresponding central tendency of the extraverts.

2. The experimental coefficient of the difference between the performance of each group is in each case so large that the chances are less than 1 in 10,000 that the difference is due to chance errors of sampling.

The Experimental Coefficient of	
The Means	6.245
The Medians	6.0787
The 90 Percentile	5.9606

3. The variability of each of the three distributions of scores of introverts is definitely larger than that of the corresponding scores of the extravert group.

The Sigma of the	Introverts	Extraverts	Ratio
Means	1.3658″	.8256″	1.6543
Medians	.7433″	.4177″	1.779
90 Percentile	4.1856″	2.5521″	1.64

4. The percentage of scores of introverts which equal or exceed the median score of the introverts is in each case significantly greater than mere chance would bring about.

The Overlap of		Standard Error	Exper. Coeff.
Mean Time Scores	87.09%	.0332	11.48
Median Time Scores	82.41%	.0374	6.00
90 Percentile Scores	76.98%	.0436	6.189

5. Considering only the correlation between the criterion and test scores for the combined group, the correlation is in each case positive and substantial.

The Biserial *r* of:	
Criterion and Mean Time	.62 ± .059
Criterion and Median Time	.487 ± .048
Criterion and 90 Percentile Time	.494 ± .058

6. Considering the introvert and extravert groups first separately and then as a combined group, the correlation between test score and age is consistently small, with large probable errors.

Pearson *r* of Age and	Introvert	Extravert	Combined
Mean Time	.016 ± .066	.041 ± .066	.05 ± .047
Median Time	.055 ± .066	.042 ± .066	.069 ± .047
90 Percentile Time	.063 ± .066	.028 ± .066	.070 ± .047

7. Considering the correlation between test score and intelligence rating, we find the correlations somewhat larger, and consistently negative.

Pearson r of Intelligence and	Introvert	Extravert	Combined
Mean Time	− .135 ± .065	− .162 ± .065	− .274 ± .043
Median Time	− .156 ± .065	− .122 ± .065	− .227 ± .045
90 Percentile Time	− .069 ± .066	− .121 ± .065	− .194 ± .046

4. THE NUMBER OF RESPONSE FAILURES

In this study, response failure was defined as failure to produce an audible word response within twenty-five seconds from the time the accented syllable of the stimulus word had been pronounced. Practically all those who have used the association test are agreed that response failure is a characteristic indicator of associative blocking.

The number of response failures was counted for each subject, and arranged in frequency distributions for the introvert and extravert groups separately, and for the two groups combined. The distributions are presented in Table XVII and the interpretations derived from the facts of this table are shown in Plate VII and in Table XVIII.

TABLE XVII

The Frequency Distribution of Response Failure Scores

Scale	Introverts	Extraverts	Combined
0	73	97	170
1	14	2	16
2	2	..	2
3	4	1	5
4	1	1	2
5	2	1	3
6	..	..	..
7	1	..	1
8	2	..	2
9	..	..	..
10	..	..	..
11	2	..	2
12	..	..	..
13	1	..	1
19	..	1	1
31	1	..	1

PLATE VII

A Comparison of the Response Failure Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	.706	.531
MEAN	1.791	.820
σ distrib.	3.818	1.977
σ mean	.3762	.195

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= .9709
σ difference	= .4236
Experimental Coefficient	= 2.292
Q	= 13 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 66.76%
σ overlap	= .0678
Experimental Coefficient	= 2.472
Q	= 7 in 1,000

Inspection of Tables XVII and XVIII and of Plate VII reveals the following facts:

a. The distributions of both groups show a markedly positive skew. The skew of the introvert group is more marked than that of the extravert group.

b. The modal trend of both distributions is toward zero failures. Of the introverts, 73, or 70.87 per cent., have this score, while 97, or 94.17 per cent., of the extraverts have it. The extraverts, therefore, tend more definitely toward zero failure than the introverts. Only 6 out of 103 extravert cases showed one or more failures of verbal response within the twenty-five seconds. Thirty introverts showed such failure of response. The introvert group shows a total of 133 failures, while the extravert group shows but 33, or a ratio of 4 to 1 failure scores.

c. The range of scores for the introvert group is 0 to 31, that of the extraverts is 0 to 19. Considering the scale as a continuous series, the standard deviation of the introvert group is 3.898;

that of the extraverts is 1.977. In other words, the variability of the introvert group is 1.932 times as great as is that of the extravert group.

d. The mean score for the introverts is .9709 larger than that of the extraverts, and the coefficient of reliability of that difference is 2.292. There are about 13 chances per 1,000 that the difference is due to chance error of sampling.

e. There is an excess of 16.76 per cent over the pure chance overlap, and the standard error of this overlap, .0678. There are 7 chances in 1,000 that it is due to chance error alone.

TABLE XVIII

THE CORRELATIONS BETWEEN RESPONSE FAILURE SCORES AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	− .008 ± .066	.004 ± .066	*.198 ± .058
r_{23}	.041 ± .066	.03 ± .066	.05 ± .047
r_{24}	− .053 ± .066	− .096 ± .066	−.039 ± .047

* Correlations preceded by an asterisk are Biserial correlations.

A study of the correlations reported in Table XVIII shows the following facts:

a. The correlation between criterion and response failure is substantially zero when the groups are taken separately, and is less than .20 when the groups are studied by the Biserial r method.

b. The correlation of test score with age is so small for the groups, both separately and when combined, that it is safe to say that age is not significantly related to response failure.

c. The correlation of test score with intelligence is no larger than that of age. Intelligence is not a significant correlative of response failure scores.

From these facts, we may conclude that while there undoubtedly is some difference in the response failure trend of the two groups being studied, the markedly skewed character of the distributions prevents that trend from revealing itself fully, with the result that the correlations are inconclusive. The differences between central tendencies, the size of the standard error of the overlap, and the wide disparity of the number of cases of zero responses point to some differentiating trend. A different method of scoring might reveal the trend more effectively. Age does not appear to be a significant function of such correlation as was found, and intelligence is only remotely as significant as the test score itself.

5. THE NUMBER OF REPRODUCTION FAILURES

Reproduction failure, as here used, is to be defined as a failure to give on the second trial with the association test the same

TABLE XIX

THE FREQUENCY DISTRIBUTION OF SCORES ON REPRODUCTION FAILURES

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Reproduction Failures:			
2– 4	1	1	2
5– 7	3	3	6
8–10	6	1	7
11–13	5	2	7
14–16	9	10	19
17–19	10	10	20
20–22	11	12	23
23–25	14	9	23
26–28	4	15	19
29–31	6	10	16
32–34	6	5	11
35–37	9	12	21
38–40	8	4	12
41–43	3	1	4
44–46	3	5	8
47–49	1	2	3
50–52	2	..	2
53–55	1	1	2
56–58	1	..	1

PLATE VIII

A Comparison of the Reproduction Failure Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	23.393	25.6999
mean	25.335	25.976
σ distrib.	11.855	10.184
σ mean	1.1681	1.003

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= .6408
σ difference	= 1.5377
Experimental Coefficient	= .4167
Q	= 338 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 41.81%
σ overlap	= .1281
Experimental Coefficient	= .6393
Q	= 261 in 1,000

response as was given on the first trial. Each word was checked separately. The reproduction failure score is the sum of the number of such failures.

The frequency distributions for the introverts, the extraverts, and for the combined groups are presented in Table XIX. In Plate VIII and Table XX will be found interpretations of these scores.

From Tables XIX and XX and Plate VIII, the following facts appear:

a. The distribution of the scores on reproduction failure are roughly symmetrical for the two groups being studied.

b. The variability of the two distributions is roughly similar. The sigma of the introvert distribution is 1.1641 times that of the extraverts. The sigma of the introverts is larger, while the mean is smaller than the corresponding items of the extravert distribution.

c. The mean reproduction failure score of the introverts is .6408 smaller than that of the extraverts, with a standard error of 1.5377. The experimental coefficient of this difference is .4167, and there are 338 chances in 1,000 that the difference is due to chance error of sampling alone.

d. The overlap of the two arrays is 41.81 per cent. A pure chance overlap would be 50 per cent. The standard error is .1281. The chances are 261 in 1,000 that the proportion is due to chance errors of sampling.

TABLE XX

THE CORRELATIONS BETWEEN SCORES ON REPRODUCTION FAILURE AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	− .016 ± .066	.046 ± .066	*− .037 ± .058
r_{23}	.134 ± .065	.049 ± .066	.092 ± .047
r_{24}	− .051 ± .066	− .145 ± .065	− .088 ± .047

* Correlations marked by an asterisk are Biserial *r* correlations.

From the correlations noted on Table XX we observe that

a. The correlation between criterion and reproduction failure is substantially zero, whether the groups are considered separately or as a combined group. Reproduction failure appears to show little or no tendency to accompany introversion-extraversion.

b. The correlation between age and the test scores is somewhat more clearly marked, though the large probable errors render conclusions uncertain. Such correlation as exists is positive. The older cases appear to tend very slightly to have more reproduction failures than the younger.

c. The correlation between intelligence and test score is consistently negative, and of about the same order as is that of age

and test score. The brighter children show a very slight tendency to have fewer reproduction failures than the duller ones.

We conclude from these facts that there is no reason to believe, as far as this study is concerned, that there is any reliable tendency of introvert children to differ from extravert children of the same age in reproduction failure scores. Such differences as exist are more likely to be due, at least in part, to differences in intelligence, or to unknown factors.

6. WORD RANGE (STEREOTYPY)

For the purposes of this study, the total number of different words used in responding to the one hundred stimulus words was considered as an index of stereotypy. The smaller the total, the more marked is the tendency to use the same responses, whether in the form of a repetition of some one word, or even of no word at all, simple blocking. Conversely, the larger the total number of words used, the freer from stereotypy the case was considered to be. The scores thus developed are presented in the form of frequency distributions for the introverts, the extraverts, and the two groups combined into one. Table XXI presents the frequency distributions, and Plate IX and Table XXII present the findings developed from the data in hand.

From the facts presented in Tables XXI and XXII and from Plate IX, the following relationships are evident:

a. The two distributions are both negatively skewed, that of the introverts more markedly so than that of the extraverts.

b. The variability of the introvert scores is 1.247 times as great as that of the extraverts, when measured in terms of the respective standard deviations.

c. The mean of the word range of the introverts is slightly smaller than that of the extraverts. The difference between the two is 1.287, with a standard error of 1.045. The experimental coefficient of the difference between the two means is 1.226. There are approximately 109 chances in 1,000 that the difference is due to errors of sampling.

d. The overlap is 4.36 per cent less than would be expected by pure chance. The standard error of this overlap is .1025. There are accordingly 335 chances in 1,000 that the overlap is due merely to chance errors of sampling.

TABLE XXI

THE FREQUENCY DISTRIBUTION OF WORD RANGE SCORES

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Number of Different Words Used in 100 Responses:			
47–48	1	..	1
49–50	..	..	..
51–52	..	..	..
53–54	..	..	..
55–56	..	..	..
57–58	1	..	1
59–60	1	1	2
61–62	..	..	..
63–64	..	..	..
65–66	1	1	2
67–68	2	2	4
69–70	..	..	..
71–72	2	..	2
73–74	1	3	4
75–76	3	2	5
77–78	1	3	4
79–80	8	3	11
81–82	7	4	11
83–84	12	10	22
85–86	10	16	26
87–88	15	16	31
89–90	15	15	30
91–92	10	11	21
93–94	5	13	18
95–96	8	3	11

From Table XXII, we observe that

a. The coefficient of correlation of criterion and word range score is consistently small whether the groups are considered separately or in combination. There is no clearly defined trend.

b. The correlation of word range score with age is small and self-contradictory. The introverts have a slight trend toward negative correlation while the extraverts show a slightly more marked trend toward a positive correlation. When the groups are combined, the correlation is practically zero.

c. Word range score and intelligence are very slightly corre-

PLATE IX

A Comparison of the Word Range Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	86.2	86.812
MEAN	84.456	85.738
σ distrib.	8.273	6.636
σ mean	.8152	.6539

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 1.2816
σ difference	= 1.045
Experimental Coefficient	= 1.226
Q	= 109 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 45.64%
σ overlap	= .1025
Experimental Coefficient	= .4254
Q	= 335 in 1,000

TABLE XXII

The Correlations between Scores on Word Range and the Criterion Ratings, Age, and Intelligence Scores of (1) a Group of 103 Introverts, (2) a Group of 103 Extraverts, and (3) the Two Groups Combined into One Composite Group

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	.067 ± .066	.004 ± .067	*− .107 ± .059
r_{23}	− .079 ± .066	.163 ± .065	.012 ± .047
r_{24}	.094 ± .065	.103 ± .065	.122 ± .946

* Coefficients marked by an asterisk are Biserial r coefficients.

lated. The correlation is positive in the separate groups, but a large probable error obscures its significance. For the combined group, it appears possible that there is a slight tendency toward positive correlation.

From the facts herewith presented, we may conclude that word range scores do not definitely differentiate between the introvert and extravert groups considered in this study, although undoubtedly the introvert group tends to have lower scores than the extravert group. The difference, however, is too unstable to be accepted as a differentiating earmark of introversion-extraversion. Neither age nor intelligence has any significant relationship with word range scores.

7. THE NUMBER OF CONTRAST RESPONSES

Jung [25] in his studies of reactions to the association test repeatedly emphasizes the fact that the subjective type is characterized by many judgments of value, by amplifications and completions, and by a persistent non-distractability, while the objective type tends to produce a "flatter" type of response with many automatized word pairs of simple contrast type. Wells [39] notes that while contrast responses form from 1 to 30 per cent of all responses to the association test, the markedly egocentric type has a prejudice against contrast responses. He finds further in later studies [40, 42] that the tendency to use fairly well-defined patterns of response, including contrast responses, is a persistent one, and that "definite fidelity to type seems to be characteristic of the subjects of this experiment."

The responses of both the introvert and the extravert group were studied to determine the number of contrast responses given by each group. All responses were considered as contrast responses which are currently accepted as antithetic or opposite, whether they are logically such or not. For instance, black-white, hot-cold, and young-old are clearly logical contrast responses. In this study, however, complementary word pairs like red-green were also considered as contrast responses.

Table XXIII presents the frequency distributions of contrast responses for the introvert, the extravert, and the combined groups. Plate X and Table XXIV present the measures of central tendency and other statistical items derived from these scores.

TABLE XXIII

THE FREQUENCY DISTRIBUTIONS OF CONTRAST RESPONSES ON THE ASSOCIATION TEST FOR THE INTROVERTS, THE EXTRAVERTS, AND THE COMBINED GROUPS

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Number of Contrast Responses:			
0– 1	43	16	59
2– 3	12	12	24
4– 5	10	9	19
6– 7	7	6	13
8– 9	4	9	13
10–11	2	3	5
12–13	6	4	10
14–15	4	7	11
16–17	3	9	12
18–19	2	6	8
20–21	..	5	5
22–23	7	4	11
24–25	1	7	8
26–27	2	2	4
28–29	..	..	..
30–31	..	1	1
32–33	..	2	2
34–35	..	..	..
36–37	..	1	1

Critical study of the data presented on Table XXIII and in Plate X leads to the following observations:

a. Both of the contrasted distributions show a heavy positive skew. The skew of the scores of the extraverts is less marked than that of the scores of the introverts.

b. The variability of the scores of the extraverts is 1.213 times that of the introvert scores. The extravert range is five class intervals greater at the upper end of the scale than is the introvert range.

c. The mean contrast reaction score of the extraverts is nearly twice as large as that of the introverts. The difference between the two means is 5.6797. The ratio of the difference between the two means and of its standard error is 4.8866. There is accordingly less than 1 chance in 10,000 that the obtained difference

PLATE X

A Comparison of the Contrast Response Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	2.416	8.889
mean	5.825	11.505
σ distrib.	7.504	9.103
σ mean	.7394	.8969

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 5.6796
σ difference	= 1.162
Experimental Coefficient	= 4.887
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 26.43%
σ overlap	= .1024
Experimental Coefficient	= 2.3017
Q	= 11 in 1,000

between the central tendencies of the two distributions is due to chance error alone.

d. The overlap is 26.43 per cent with a standard error of the overlap of .1024. There are less than 11 chances in 1,000 that the overlap is due only to a chance difference between the contrasted groups.

From Table XXIV, it appears that

a. The correlation between the criterion and contrast response scores is small when the separate groups are contrasted. When, however, the two groups are combined, the Biserial r is $-.406 \pm .051$. In other words, there is probably a tendency for the number of contrast responses to decrease with increase in introvert rating.

b. The correlation of age and contrast response score is small and positive. In the case of the extravert group, it approaches zero. The correlation of the combined group scores with age

TABLE XXIV

THE CORRELATIONS BETWEEN SCORES ON CONTRAST RESPONSES AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	− .038 ± .066	.006 ± .067	*− .406 ± .051
r_{23}	.117 ± .065	.024 ± .066	.027 ± .047
r_{24}	.036 ± .066	.166 ± .065	.176 ± .046

* Coefficients marked by an asterisk are Biserial *r* coefficients.

is practically zero. Contrast response does not appear, as far as this study goes, to be a matter of age.

c. The correlation of intelligence with contrast response scores is uniformly positive, but small. It is large enough in the case of the extravert group and in the combined group to suggest a slight tendency for higher intelligence to accompany high contrast scores. The probable error is so large, however, as to make the trend very doubtful.

Within the limits of this study,[1] introverts have a definite tendency to a more restricted use of contrast responses than extraverts. Age is not a function of contrast response, and intelligence is only slightly so.

[1] There are other aspects of the free association test which give promise in the study of introversion-extraversion. Space forbids reporting on them here.

CHAPTER VI

THE INK BLOT TEST AND INTROVERSION-EXTRAVERSION

Earlier Uses of Ink Blot Tests

Studies based on ink blots have been reported by Dearborn, [49] Whipple [50], Sharp [51], Bartlett [52], Parsons [53], McGeogh [54], Rorschach [55], and others.

Whipple [50] was impressed with the possibilities of the test as a measure of imagination. He summarizes the studies which had appeared up to 1915 and proposes a standard series of twenty blots. He suggests that subjects tend roughly to fall into one of each of the following pairs of types, "active and passive imagination," "non-constructive and constructive," "matter-of-fact and imaginative," "subjective and objective."

Bartlett [52] found that the responses of his subjects were either dominantly reminiscent, or dominantly general. The first type was essentially quick in response, emotional, productive. The second was slower, more inhibited, with emotions relating not to the product, but to the process as such.

Parsons [53] worked with children of seven to seven and one-half years, and found active and passive types in her group, with the latter predominant.

McGeogh [54] used Whipple's arrangement, and scored for quantity and quality of response. He found correlations with Army Alpha as follows:

McGeogh's Correlation of Ink Blot Scores With Performance on Army Alpha Test

Variables	Men	Women
Ink Blot Quantity	.004	.265
Ink Blot Quality	− .003	.160

Rorschach in 1921 published a work on *Psychodiagnostik* [56] in which he used two-colored ink blots for a diagnostic apperception experiment. He proposed by means of the manner, quality, and quantity of responses to a series of ink blots to analyze the mental trends of persons referred to him for consultation. His system is intricate, somewhat suspiciously picturesque, but it bristles with suggestions. After his death in 1922, a posthumous paper was published [55] to which reference has been made. Dr. Rorschach was convinced that by the method of attack and by quantity and quality of the material produced, the subject betrays his make-up.

Description of Test Used Here

The present experiment with the ink blot test was of necessity simple because of the limited time available for it. Two typical ink blots were selected from Whipple's ink blot series, printed on separate cards, and exposed to the subjects one at a time, each for a period of two minutes.

Each experimenter was instructed to use the following instructions verbatim, both in giving the test and in scoring it.

Directions for Ink Blot Test

Provide the two standardized *Ink Blots,* printed on cards.

Place them face down on the table.

Picking up Card 1 and holding it so that your subject cannot see the blot, say to him:

"On this card there is an odd-shaped ink blot. Most people see all sorts of queer things in it when they look at it. I am going to ask you to look at it, and tell me all the different things it makes you think of. Are you ready? All right. Go!"

With this, lay the card down face up before your subject, in such a way that the side marked "Bottom" is toward him. *Do not allow the card to be turned.*

Expose the card just two minutes by your stop watch

Record on the blank everything which your subject produces about Blot 1.

If your subject does not understand, or does not begin to produce within *fifteen seconds* after exposing the card, encourage him by suggesting an item which may be clearly seen in the blot. Give no further aid.

After the lapse of two minutes remove the first blot, and present the second one, saying:

"Let's try this one in exactly the same way. What do you see in it?"

Expose this one also *two minutes,* bottom toward your subject, the card not to be moved about, nor to be viewed from the sides or top.

Record carefully everything produced by your subject. Record any oddities of behavior during the test, any irrelevant remarks, or emotional display.

There are two scores:

(*a*) Quantity=Total number of separate items seen in the two blots in the four minutes.

(*b*) Quality =Total number of words produced, less articles. Compound verb forms count as only one word.

The results of the tests so given were approached from various angles. Separate counts were made of nouns, adjectives, adverbs, and verbs—verbs of action and of status. These were sampled in various combinations, in order to utilize the attacks suggested by Rorschach. The two studies herewith presented were finally selected for inclusion in this report.

1. INK BLOT TEST: SUM OF NOUNS, ADJECTIVES, AND ADVERBS

Scores in this study represent in each case the sum of all the nouns, adjectives, and adverbs which were produced by each of the subjects of the test in connection with his direct response to the two ink blots. Introductory statements, e.g., "It looks a little like it might be," "It reminds me of," "I see," etc., were not counted, since the purpose was to study the contrasted productiveness of our two groups. Participles were counted as adjectives. Pronouns were counted as nouns, provided they referred to ideas contained in the blot. Adjectives were counted, if they were used to qualify or describe the blot or ideas suggested by it. Adverbs were counted if they qualified some attribute or some verb relating to the blot.

The scores thus built up are presented in the form of frequency distributions in Table XXV. Plate XI and Table XXVI present interpretations based on these frequency tables.

From an inspection of Table XXV and Plate XI, the following facts appear:

a. The distribution of the ink blot noun scores of both groups approaches that of a normal frequency.

b. The range of the scores of the introverts extends from 2 to 46, that of the extraverts from 5 to 76, a difference of 27 steps. The sigma of the extraverts is 1.209 times as large as that of the introverts.

c. The difference between the means of the two contrasted distributions is 7.0485, with a standard error of 1.5178. The experi-

TABLE XXV

THE FREQUENCY DISTRIBUTION OF SCORES ON INK BLOTS (NOUNS, ADJECTIVES, AND ADVERBS)

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Sum of Nouns, Adjectives, and Adverbs Produced:			
2– 4	3	..	3
5– 7	6	1	7
8–10	8	1	9
11–13	14	8	22
14–16	11	7	18
17–19	14	11	25
20–22	6	13	19
23–25	5	10	15
26–28	12	12	24
29–31	9	9	18
32–34	6	6	12
35–37	5	5	10
38–40	2	10	12
41–43	1	3	4
44–46	1	1	2
47–49	..	..	..
50–52	..	2	2
53–55	..	2	2
56–58	..	..	..
59–61	..	..	..
62–64	..	..	..
65–67	..	1	1
68–70	..	..	..
71–73	..	..	..
74–76	..	1	1

mental coefficient of the difference between the contrasted means is 4.6038. There is less than 1 chance in 10,000 that the difference between the means of the ink blot noun scores of the two groups here being considered is due to chance errors alone.

d. The percentage of introvert scores which equals or exceeds the median scores of the extraverts is 27.99 per cent. Mere chance would produce 50 per cent. if there were no real difference in the response trend of the two groups. The standard error of the overlap is .1204. The chances are only 34 in 1,000

PLATE XI

A Comparison of the Scores Made by a Group of 103 Introverts on Ink Blot Nouns, Adjectives, and Adverbs with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	19.535	26.625
MEAN	19.723	26.791
σ distrib.	9.819	11.869
σ mean	.9675	1.1695

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 7.0485
σ difference	= 1.5178
Experimental Coefficient	= 4.6838
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 27.99%
σ overlap	= .1204
Experimental Coefficient	= 1.828
Q	= 34 in 1,000

that the overlap is due to chance errors, and may disappear with further sampling.

Table XXVI shows that

a. The correlation between criterion and ink blot noun scores is small, but consistently negative in both the separate and the combined groups. The correlations are large enough to indicate a definite trend toward greater productiveness on the part of the extraverts than of the introverts.

b. The correlation of ink blot noun scores with the ages here considered is substantially and consistently zero, whether the groups are considered separately or together.

c. The correlation of intelligence with ink blot noun scores is only slightly larger than is that of age, and is uncertain in quality.

In spite of the abbreviated character of the test, using but two blots, each exposed for two minutes, a definite trend toward

TABLE XXVI

THE CORRELATIONS BETWEEN SCORES ON INK BLOT NOUNS, ADJECTIVES AND ADVERBS AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	− .166 ± .065	− .112 ± .065	*− .386 ± .052
r_{23}	− .011 ± .067	.066 ± .066	.025 ± .047
r_{24}	.045 ± .066	− .048 ± .066	.065 ± .047

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

correlation is indicated. It would have been useless to extend the time of exposure of the individual blots, since very few subjects of either group produced anything after the lapse of ninety seconds. Fifty cases were selected at random, and the correlation between performance on the two blots calculated. The self-correlation was .76 ± .042. An increase in the number of blots employed might possibly produce a diagnostic test device for the discovery of introvert-extravert trends.

Age does not appear to be a function of ink blot noun scores, and intelligence functions only to a slight degree.

2. INK BLOT TEST: VERBS

As indicated above, the results of the ink blot test were studied from a variety of angles. Rorschach in his studies [55, 56] concluded that introverts tended toward verbs of action, while extravert responses were not so characterized. Accordingly, the verbs in the responses of our two groups were studied from a variety of angles. It finally appeared that, at least for the groups here in hand, action verbs did not specially characterize the reactions of introverts, but that introverts did tend slightly to produce more verbs than the extraverts did. Accordingly, the verbs produced by each subject were tabulated, and subjected to the same statistical treatment to which the ink blot nouns had been subjected. In counting the verbs, all compound forms were

counted as one verb. Only those verbs were counted which referred to the items discovered in the blots. Introductory verbs and phrases, "It looks as if it might be," etc., were not counted.

The data thus collected will be found in the form of frequency distributions in Table XXVII and the interpretations of these data may be found in Plate XI and Table XXVIII.

A careful comparison of the distributions found in Tables XXV, XXVI, XXVII, and XXVIII, and in Plates XI and XII reveals some interesting facts:

a. While the mean of the ink blot noun scores of the extraverts tends to be greater than that of the introverts, the trend is reversed in the case of the verb scores. The introvert noun distribution is compact and fairly symmetrical, the introvert verb

TABLE XXVII

THE FREQUENCY DISTRIBUTION OF SCORES ON INK BLOTS
(VERBS)

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Sum of Verbs Produced:			
0	47	58	105
1	21	11	32
2	10	8	18
3	7	7	14
4	6	9	15
5	2	5	7
6	1	2	3
7	4	2	6
8	1	..	1
9	1	1	2
10	..	..	..
11	1	..	1
12	..	..	..
13	..	..	..
14	1	..	1
15	..	..	..
16	..	..	..
17	..	..	..
18	..	..	..
19	..	..	..
20	..	..	..
21	1	..	1

PLATE XII

A Comparison of the Scores Made by a Group of 103 Introverts on Ink Blot Verbs with the Scores Made by a Group of 103 Extraverts on the Same Test

I. Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	1.214	.8890
MEAN	1.374	.8981
σ distrib.	3.183	2.030
σ mean	.3136	.2

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= .4757
σ difference	= .372
Experimental Coefficient	= 1.2789
Q	= 103 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 59.44%
σ overlap	= 1.3351
Experimental Coefficient	= .0707
Q	= 472 in 1,000

distribution is skewed to the right. The reverse holds true of the respective scores of the extravert group. The trends of ink blot noun scores and of ink blot verb scores are opposed. Extraverts have an excess of nouns, adjectives, and adverbs; introverts have a slight excess of verbs.

b. The variability of introvert verb scores is 1.567 times that of the extravert scores. The range of the scores of the introverts, 0 to 21, is 2.1 times that of the extraverts, 0 to 9.

c. The difference between the mean scores of the introverts and extraverts is .4757, with a standard error of .372. The experimental coefficient of the difference is 1.27. There are about 110 chances in 1,000 that the difference is not a real difference, but is due to chance errors of sampling.

d. The overlap is 59.4 per cent. There is a marked trend toward zero scores on the part of both groups. If the test were lengthened by increasing the number of blots used, the zero trend of the extraverts might be modified. The standard error of the

TABLE XXVIII

THE CORRELATIONS BETWEEN SCORES ON INK BLOT VERBS AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF: (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	− .156 ± .065	.007 ± .067	* .111 ± .059
r_{23}	− .027 ± .066	.038 ± .066	.047 ± .047
r_{24}	− .214 ± .064	.019 ± .066	− .099 ± .046

* Coefficients preceded by an asterisk are Biserial r coefficients.

overlap is 1.335. The chances are 472 in 1,000 that the overlap depends on chance errors of sampling.

A consideration of the correlations noted in Table XXVIII suggests that

a. The correlations between the criterion and ink blot verb score are confusing and small. There is no certain correlation between ink blot verb score and criterion rating. There may, however, be some slight difference in the correlation trend of the introverts and extraverts, which is obliterated by our present technique.

b. Between age and ink blot verb score, the correlations approach zero. Such differences as appear between the trend of the introverts and extraverts are chance differences, as may be seen from the respective probable errors.

c. Intelligence and ink blot verb scores seem to be more nearly correlated in the case of the introverts than in that of the extraverts. Introversion is negatively correlated —.214, while extraversion has a correlation coefficient of .018. Apparently, there is a tendency for the more intelligent introvert to produce fewer verbs than the less intelligent one. The trend does not appear among the extraverts.

We may conclude from these facts that there appears to be a slight tendency for introverts to make more verb responses to

ink blots than are made by extraverts, and that to a slight degree intelligence is a function of this tendency in the case of introverts. It may be that the factor which is here called intelligence is really freedom from subjective blocking. With extraverts, however, intelligence does not seem to exert the same influence. Possibly the responses are controlled by other tendencies. In the case of neither extravert nor introvert does age within the limits of the groups here considered appear to be correlated with verb production in response to the ink blot stimulus.

Summary of Ink Blot Study

1. When nouns, adjectives, and adverbs are scored, introverts tend definitely to produce less freely than extraverts in the ink blot test.

2. When verbs alone are counted, introverts as a class show a slight tendency to produce more freely than extraverts.

3. The results at hand are confusing but they do not suggest that introverts tend to react more often with kinetic ideas than extraverts do. Rorschach's generalization [56] could not be established.

4. It is possible that the ink blot test could be developed as to length and technique to a point at which it would become a reliable unit in a battery of introversion-extraversion tests.

5. Age is not a function of productiveness in the ink blot test, within the limits of the groups studied here.

6. Intelligence appears to be only moderately related to productiveness in the ink blot test, and then more in the case of the introverts than in the case of the extraverts.

CHAPTER VII

MOTOR OUTPUT AND INTROVERSION-EXTRAVERSION

Earlier Studies of Motor Output

Dr. June Downey, writing on Speed and Fluidity of Reaction [57] says that "speed of movement is characteristic of the explosive temperament." Conversely, she declares that persons of leisurely habit, and "lack of pep" will score low on a test of speed of movement. She makes these observations the basis of a method of interpreting the results of speed of writing scores. She suggests also that the tapping test might be substituted without serious loss for the writing samples which she used. Quoting from Laukes [58], Downey claims a self-correlation of .85 for the results of two tapping tests given on two consecutive days.

Whipple [59] reports the tapping test at some length and concludes that "constant individual differences can be demonstrated without much difficulty." The differences may be "conditioned in a general way by fundamental neural factors, or by these plus differences in ability to coördinate voluntary movement."

Wells [60] thinks that in the test two factors operate to contribute to speed or lack of it; one, the factor of "a refractory phase of the synapses in the motor pathways," the second, that of motor coördination.

From these studies and from earlier studies of related materials, it was thought that some form of motor output test had possibilities for the present investigation.

Description of the Test Used

Optimum psychological tests reduce mechanical complications to a minimum, in order not to introduce adventitious factors. At the same time they are reliable and produce a permanent record. A combination of procedures originally used by Binet and Vaschide [61] and by Downey was selected for the present in-

vestigation. The method has the advantage of simplicity, gives a permanent record, and does not introduce extraneous disturbing factors.

Verbatim directions used in giving the test are presented here.

Directions for Motor Output Test

Provide a card or slip of paper on which you have made a series of marks like the following: //

Place this sample before your subject and say:

"You see the marks on this sheet? Please take your pencil and when I say 'Ready? Go!' start to make marks like this right here after the figure one. Keep right on till I say 'Stop.' Make the marks at your own natural writing speed. This is not a speed test; it is just to find out your natural rate of marking. Ready? Go!"

Start the stop watch, and at the end of ten seconds say: "Stop! Now we will do the same thing once more. Start here. (Point to figure 2.) Remember, your own natural speed, just the way you write. (Reset your watch.) Ready? Go!"

A third trial is given exactly like the second. The time of each trial is ten seconds.

After the third trial continue the test by saying: "Now I want to see how fast you can make these marks. This next time I want you to make your marks just as fast as you possibly can here after the number four. Keep right on till I say 'Stop!' Remember, just as fast as you can. Ready? Go!"

Follow this trial by two more trials, introducing each with the words: "Now once more the same thing. Start here. (Point to appropriate figure.) Just as fast as you possibly can! Ready? Go!"

All six trials are to be just ten seconds in length.

Score for the first three trials is the sum of the marks made in the three trials. This is the *unspeeded score.*

The sum of the marks made in the last three trials is the *speeded score.*

The sum of the unspeeded and speeded scores is the *total score.*

The ratio of the speeded score divided by the unspeeded is the *index of kinetic reserve.*

In case of a pencil failure, start the trial again.

Scores Developed

From the data thus secured, four sets of scores were derived and studied for their possible relationship to introversion-extraversion. They will be presented in the following order:

1. The unspeeded motor output scores.
2. The speeded motor output scores.
3. The total motor output scores.
4. The index of kinetic reserve.

There were significant qualitative differences in the performance which in a few cases reached striking proportions. There is, however, no available technique for presenting these differences numerically, and they are for that reason not discussed in the present study.

1. THE UNSPEEDED MOTOR OUTPUT SCORES

As indicated, each subject produced three samples of unspeeded marking, each trial lasting ten seconds. The marks made were

TABLE XXIX

THE FREQUENCY DISTRIBUTION OF UNSPEEDED MOTOR OUTPUT SCORES

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Sum of Marks Made in Three Unspeeded Trials:			
16– 20	1	..	1
21– 25	4	1	5
26– 30	..	1	1
31– 35	1	..	1
36– 40	6	3	9
41– 45	10	3	13
46– 50	9	4	13
51– 55	6	7	13
56– 60	11	6	17
61– 65	8	12	20
66– 70	9	13	22
71– 75	11	13	24
76– 80	5	9	14
81– 85	3	6	9
86– 90	5	5	10
91– 95	4	2	6
96–100	2	2	4
101–105	1	6	7
106–110	3	4	7
111–115	2	..	2
116–120	1	3	4
121–125	..	1	1
126–130	..	1	1
131–135	..	..	..
136–140	..	..	..
141–145	1	1	2

PLATE XIII

A Comparison of the Unspeeded Motor Output Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	62.189	70.577
mean	64.248	73.422
σ distrib.	18.417	21.986
σ mean	1.815	2.167

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 9.1748
σ difference	= 2.8259
Experimental Coefficient	= 3.2467
Q	= .5 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 35.66%
σ overlap	= .1772
Experimental Coefficient	= .8092
Q	= 209 in 1,000

counted and checked for errors, and the sum of the marks produced in the three trials were used as the unspeeded score.

Table XXIX presents the scores thus secured in the form of three frequency distributions; one for the introvert group, one for the extravert group, and one for the two groups combined.

Plate XIII and Table XXX present the results of the statistical analysis of these scores.

A careful examination of Tables XXIX and XXX and of Plate XIII shows the following facts:

a. The distribution of the scores of both contrasted groups is approximately normal.

b. The variability of the scores of the extraverts is 1.1938 times that of the scores of the introverts. The difference in variability is relatively small.

c. The mean score of the extraverts is definitely larger than that of the introverts. The difference between the two means

is 9.1748, and the standard error of that difference is 2.8259. The experimental coefficient of the difference between the two means and of its standard error is 3.247. The chances are only 5 in 10,000 that the difference is due primarily to chance errors of selection.

d. The overlap is 35.66 per cent., with a standard error of .1772. By pure chance the overlap would be 50 per cent. The deficiency is 14.34 per cent. The chances are 209 in 1,000 that the overlap represents only a chance difference in the relationship between the trends of the two distributions.

TABLE XXX

THE CORRELATIONS BETWEEN SCORES ON UNSPEEDED MOTOR OUTPUT AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	− .052 ± .066	.050 ± .066	*− .250 ± .056
r_{23}	.109 ± .065	.062 ± .066	.062 ± .046
r_{24}	− .165 ± .065	− .018 ± .066	− .031 ± .047

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

A consideration of Table XXX shows some interesting facts:

a. The correlations between unspeeded motor output score and criterion rating are small and contradictory. The introvert group shows a slight trend toward a negative correlation; the extravert shows an equally slight trend in a positive direction. For the combined groups, the correlation is negative and perhaps indicative of a trend toward a reliable correlation.

b. The correlation of age and unspeeded motor output is consistently positive, but so small that it is safe to say that there is substantially no correlation. Assuming that any correlation that was actually found is the most probable correlation, then the tendency of the introvert group toward a positive correla-

tion is somewhat more marked than is that of the extravert or of the combined group.

c. Intelligence and unspeeded motor output are negatively but not consistently correlated.

From the foregoing, it would appear that there is a real difference between the central tendencies of the introvert and extravert groups in the unspeeded motor output test.

It is quite certain that for the groups here studied neither age nor intelligence is in any large sense a function of this performance, except in the case of the introverts where the older subjects have a very slight tendency to do better than the younger ones, and where the less intelligent tend slightly to do better than the more intelligent. In neither case is the trend pronounced, and it all but disappears when the combined group is considered.

2. SPEEDED MOTOR OUTPUT SCORES

Three trials of speeded motor output were given. Each trial, as indicated above, lasted ten seconds, and represented the subject's output when he was working at top speed. The score consisted of the sum of the marks made in the three trials.

These scores are presented in Table XXXI, in the form of three frequency distributions, one each for the introverts, the extraverts, and the combined group. Plate XIV and Table XXXII present the results of the statistical analysis of these scores.

Examination of Table XXXI and Table XXXII and of Plate XIV suggests the following facts:

a. While the form of the distribution of the scores of the introverts is approximately that of a normal frequency, the distribution of the scores of the extraverts is skewed somewhat to the left. Three extravert cases, which suggest chance variants, are far down the scale, quite separate from the rest of the extravert group. Apart from these three cases, the extravert curve is regular.

b. The variability of the scores of the introverts is slightly larger than that of the extraverts. The ratio of the sigmas is 1.1062. Were it not for the three possibly adventitious cases mentioned, the difference would be definitely greater.

c. The mean of the scores of the extraverts is greater by 12.235 than that of the scores of the introverts. The standard error

TABLE XXXI

THE FREQUENCY DISTRIBUTION OF SCORES ON SPEEDED MOTOR OUTPUT

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Sum of Marks in Three Speeded Trials:			
36– 42	1	2	3
43– 49	1	..	1
50– 56	2	..	2
57– 63	..	1	1
64– 70	4	..	4
71– 77	1	..	1
78– 84	3	..	3
85– 91	6	1	7
92– 98	10	4	14
99–105	7	9	16
106–112	8	8	16
113–119	14	16	30
120–126	12	6	18
127–133	15	19	34
134–140	5	9	14
141–147	6	11	17
148–154	4	5	9
155–161	2	7	9
162–168	..	4	4
169–175	1	..	1
176–182	..	1	1
183–189	1	..	1

of the difference is 3.507. There are only 2 chances in 10,000 that the difference is a chance difference, due to errors of selection.

d. The overlap is 29.57 per cent with a standard error of .2975. The chances that the deviation from the expected overlap of 50 per cent, which would be the most likely overlap if chance alone were involved, will become zero are 247 in 1,000. The situation is again rendered uncertain by the presence of the three adventitious cases referred to on the preceding page.

Correlation Table XXXII suggests the following conclusions:

a. The correlation between criterion and speeded motor output is consistently negative, both for the separate groups and for the combined group. The correlation is small, but large enough

PLATE XIV

A Comparison of the Speeded Motor Output Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	116.25	127.6579
mean	113.2557	125.4903
σ distrib.	26.268	23.7452
σ mean	2.5882	2.3397

II. The Measures of Difference and Its Reliability

Difference between the Mean Scores	= 12.2346
σ difference	= 3.49
Experimental Coefficient	= 3.5066
Q	= .2 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 29.57%
σ overlap	= .2975
Experimental Coefficient	= .6837
Q	= 247 in 1,000

to be significant when it is recalled that correlations in the separate groups have probably suffered some constriction.

b. The correlation of age and speeded motor output score is positive throughout, and large enough to indicate some consistent trend toward faster speeds with greater age. The striking contrast here with the negative relationship between criterion and test score is worthy of note. Age and criterion are not related, age and speeded motor output score suggest a positive correlation, but criterion and test score point toward a negative correlation.

c. The correlation between test score and intelligence rating approaches zero, whether the groups are studied separately or in combination. Neither speeded nor unspeeded score is related in this study to intelligence.

It would appear that there is a practically certain difference in the scores of introverts and extraverts on both the speeded

TABLE XXXII

THE CORRELATIONS BETWEEN SCORES ON SPEEDED MOTOR OUTPUT AND THE CRITERION, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	− .178 ± .064	− .108 ± .065	*− .328 ± .050
r_{23}	.181 ± .064	.180 ± .064	.14 ± .04
r_{24}	− .061 ± .066	.048 ± .066	.069 ± .046

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

and unspeeded motor output tests. The correlation of both scores with the criterion tends to be negative, the speeded scores decidedly more so than the unspeeded. The speeded scores are decidedly more dependent on age than are the unspeeded scores, and neither speeded nor unspeeded scores are dependent on intelligence. It may be that lengthening the test in accord with the Spearman-Brown formula would materially improve the correlation and would result in a really diagnostic test.

3. TOTAL MOTOR OUTPUT SCORES

It was thought that the slight trend toward correlation of motor output with criterion might come more fully to light if a larger sampling of output were used. The sum of the speeded and unspeeded performances was therefore used as the basis of a new series of scores, which are presented in Table XXXIII, arranged in three frequency distributions, one each for the introvert group, the extravert group, and the two combined into one group. Plate XV and Table XXXIV show the results of the study of these scores in terms of the usual criteria. Scores are the sum of all marks made in all six trials.

A study of Tables XXXIII and XXXIV and of Plate XV reveals among other things the following facts:

a. The distributions of the scores of both introverts and ex-

TABLE XXXIII

THE FREQUENCY DISTRIBUTION OF SCORES ON TOTAL MOTOR OUTPUT—THREE SPEEDED, AND THREE UNSPEEDED TRIALS

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Sum of Marks on Speeded and Unspeeded Trials:			
51–60	1	..	1
61–70	..	1	1
71–80	3	1	4
81–90	1	..	1
91–100	..	1	1
101–110	3	..	3
111–120	2	..	2
121–130	3	..	3
131–140	3	2	5
141–150	5	4	9
151–160	8	5	13
161–170	13	10	23
171–180	9	6	15
181–190	15	8	23
191–200	9	15	24
201–210	8	11	19
211–220	8	7	15
221–230	2	5	7
231–240	1	12	13
241–250	3	6	9
251–260	1	2	3
261–270	1	3	4
271–280	2	2	4
281–290	..	1	1
291–300	1	..	1
301–310	1	..	1
311–320	..	1	1

traverts approach the normal frequency type, though the extravert scores are somewhat more skewed than are those of the introverts.

b. The variability of the introvert group is only slightly larger than that of the extravert group. The ratio is 1.0839. The range is substantially identical.

c. The mean score of the extravert group is larger than that of the introvert group. The difference is 21.8417 and the probable

PLATE XV

A Comparison of the Total Motor Output Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	180.333	199.0
mean	178.204	200.146
σ distrib.	45.311	41.801
σ mean	4.465	4.119

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 21.942
σ difference	= 6.047
Experimental Coefficient	= 3.6123
Q	= .01 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 28.06%
σ overlap	= .5169
Experimental Coefficient	= .4245
Q	= 336 in 1,000

error of the difference is 6.0742. The experimental coefficient of the difference is 3.6123. The chances are less than 1 in 10,000 that the difference is due to chance errors in sampling alone.

d. The overlap is 28.06 per cent with a standard error of .5169. There are 336 chances in 1,000 that the overlap will become 50 per cent. Roughly, the chances are 7 in 10 that the overlap is a reliable one, and not due to chance errors.

A study of the correlation reported in Table XXXIV reveals the following facts:

a. The correlation of the total motor output score with criterion rating is with one exception negative throughout as may be seen by consulting the following summary of correlations, between criterion and motor output scores. It appears that combining the unspeeded motor output score with the speeded score does not improve the correlation. The best correlation is that of criterion with speeded motor output score. The question is

raised whether the judges in rating were not unconsciously influenced by the vivacity and motor nimbleness of these subjects.

Correlation of Criterion With The Variables Below	Introvert	Extravert	Combined (Biserial r)
1. Unspeeded Score	− .052	.050	− .250
2. Speeded Score	− .178	− .108	− .328
3. Total Score	− .111	− .041	− .308

b. The correlation of age and total motor output score shows the same trend that has already been pointed out. It is less than in the case of speeded output scores and tends to be more than in the case of the unspeeded score.

TABLE XXXIV

The Correlations between Total Motor Output Scores and the Criterion Ratings, Age, and Intelligence Scores of (1) a Group of 103 Introverts, (2) a Group of 103 Extraverts, and (3) the Two Groups Combined into One Composite Group

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	− .111 ± .065	− .041 ± .066	*− .309 ± .057
r_{23}	.084 ± .066	.111 ± .065	.116 ± .046
r_{24}	− .132 ± .065	− .010 ± .067	− .001 ± .047

* Coefficients preceded by an asterisk are Biserial r coefficients.

c. The correlation between intelligence and total motor output shows substantially a similar tendency. One may conclude from these facts, that it is not the number of marks but the factor of urgent speed, or rapid mobilization of motor drive which is the significant factor of this test, and that the test could probably be most effectively improved by lengthening the speeded output.

The total motor output score is less effective in differentiating introverts and extraverts than the speeded motor score. It

would seem as though a characteristic motor readiness, a free flow of power were the distinguishing characteristic between the groups here studied, and that this factor is not effectively called into play in the unspeeded motor test. Further experimentation with the two types of attack would doubtless bring the contrasted trends more clearly to light. In any case the differences between the central tendencies of the scores of the contrasted groups on both the speeded and the unspeeded tests indicate that a real difference exists between the trends. It remains for future studies to classify and further define the apparent trends. We have already seen some indications of this tendency in our discussion of the multimental test.

4. INDEX OF KINETIC RESERVE

Downey [57] believes that the ratio between speeded and unspeeded performance measures the tendency to maintain speed without external pressure. By dividing normal or unspeeded score by the speeded score in her motor output test, she secures an index of inertia or "load." Her scores are in terms of time. Slow speed of movement and "load" when they occur together in the same individual seem to be indicative of psychopathic trends that suggest dementia praecox.

There seemed reason to believe that the ratio of speeded to unspeeded motor output "would be a measure of the available motor reserve for the performance of the task set." It was conceivable that this specific "Kinetic Reserve" might be correlated with the permanent pattern or make-up of the personality.

The unspeeded motor output scores were accordingly used to divide the speeded motor output scores. The quotient was called an "Index of Kinetic Reserve." The resulting scores are presented in the form of three frequency distributions in Table XXXV. In Plate XVI and Table XXXVI will be found the results of a statistical analysis of these scores.

The following facts gleaned from Table XXXV and Plate XVI and from Table XXXVI are worthy of note:

a. Both of the distributions are slightly skewed to the right, the distribution of the introvert scores somewhat more so than that of the extravert scores.

b. The variability of the introvert scores is 1.18 times that of the extravert scores, as measured by their respective sigmas.

TABLE XXXV

THE FREQUENCY DISTRIBUTION OF SCORES ON KINETIC RESERVE

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Scores on Kinetic Reserve:			
91–100	1	1	2
101–110	1	..	1
111–120	2	3	5
121–130	5	5	10
131–140	6	8	14
141–150	10	8	18
151–160	14	10	24
161–170	9	12	21
171–180	7	9	16
181–190	7	10	17
191–200	10	10	20
201–210	5	5	10
211–220	3	5	8
221–230	2	6	8
231–240	8	6	14
241–250	2	..	2
251–260	1	..	1
261–270	..	1	1
271–280	2	2	4
281–290	2	..	2
291–300	1	1	2
301–310	1	..	1
311–320	2	..	2
321–330	..	..	..
331–340	..	1	1
341–350	..	..	..
351–360	..	..	..
361–370	2	..	2

c. The mean score of the introverts is slightly larger than that of the extraverts. The difference between the two means is 4.078, with a standard error of 6.277. The experimental coefficient of the difference is only .6496, and there are 258 chances in 1,000 that the difference is one of mere chance. The difference is not a reliable one, and has little or no diagnostic value.

d. The overlap is 50 per cent, which is precisely the overlap which chance would bring about. The standard error is .4558,

PLATE XVI

A Comparison of the Kinetic Reserve Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	175.	175.
mean	183.835	179.757
σ distrib.	48.598	41.1921
σ mean	4.7884	4.0587

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 4.0777
σ difference	= 6.277
Experimental Coefficient	= .6496
Q	= 258 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 50%
σ overlap	= .4558
Experimental Coefficient	= .000
Q	= 500 in 1,000

with 500 chances in 1,000 that this overlap is determined solely by chance. Neither the difference between the means nor the overlap points toward a distinguishing trend for either of the distributions as compared with the other.

The facts reported on Table XXXVI suggest the following conclusions:

a. The correlations between criterion and Kinetic Reserve scores are confusing and inconclusive. For the introverts, the correlation approaches zero; for the extraverts, it is —.145; for the combined groups, the Biserial $r = .054$. In so far as any tendency is indicated, it is on the part of the extravert group, which shows a slight tendency toward high kinetic reserve scores for those who are more markedly extravert. They show a slight tendency to speed up more markedly under pressure. The rest of the correlations with the criterion are negligible.

b. The correlations of age with kinetic reserve scores are con-

TABLE XXXVI

THE CORRELATIONS BETWEEN KINETIC RESERVE SCORES AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	.003 ± .067	− .146 ± .065	* .054 ± .059
r_{23}	.024 ± .066	.017 ± .066	.028 ± .046
r_{24}	.164 ± .064	.024 ± .066	.128 ± .045

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

sistently positive but substantially zero. Age is not, within the limits of this study, a function of kinetic reserve.

c. The correlations of intelligence with kinetic reserve are all positive but variable in amount. Only the introverts show an uncertain but fair trend toward a correlation, $r = .164$. Intelligence is not dependably a concomitant of either a high or low kinetic reserve score, though some slight trend toward correlation is indicated.

From the foregoing, it would seem that the ability to increase motor output beyond the ordinary unspeeded output is not in itself diagnostic of either introversion or extraversion. The present facts, therefore, do not warrant the use of the kinetic reserve concept in the diagnosis of introversion-extraversion.

There is a possibility that combining the kinetic reserve score with the unspeeded motor output score would produce a better correlation. Downey thinks that slow movement and great "load," in this case low kinetic reserve score, are indicative of inhibited, psychopathic personalities. Poffenberger and Carpenter [62] found that a combination of scores on speed of movement and freedom from load formed a score that was prophetic of success in scholastic achievement even in those whose intelligence was relatively low. The further study of this matter must await a more extensive investigation.

Summary of Motor Output Study

The motor output test as here used shows best promise of differentiating between introverts and extraverts when the speeded scores are considered. The unspeeded scores do not so clearly differentiate, though the introverts are undoubtedly slower as a group than the extraverts when working at their own natural rate.

The speeded score brings the difference most clearly to light. The introverts are definitely slower than the extraverts when under pressure, and this trend shows some consistent tendency to be negatively related to the criterion scores in both groups. The most introverted cases tend to be slow; the most extraverted cases tend to be fast. The older members of both groups incline to be faster than the younger, regardless of intelligence.

Combining the speeded and unspeeded scores does not tend to differentiate the two groups as well as the speeded scores alone. As already indicated, the two groups differ less in "natural rate" than in their absolute output under pressure, at least when the time of action is restricted to three trials, at ten seconds per trial.

The kinetic reserve index does not bring to light any reliable difference between the two contrasted groups. The scores overlap by 50 per cent, and the correlations approach zero except in the case of the extraverts, where a slight negative correlation, $r = -.145$, appears.

CHAPTER VIII

MULTIPLE CHOICE AND INTROVERSION-EXTRAVERSION

General Considerations

Substantially, every enumeration of introvert-extravert traits emphasizes the difference in speed of intellectual and emotional reaction. It would seem as though this tendency to accelerated or retarded reaction, to quick or slow decision and finality or insecurity of judgment should be susceptible of demonstration and of measurement.

Ten stereoscopic views, touching a varied range of human interests, were accordingly presented to the subjects of the present study, for arrangement in the order of their individual preference. It was thought that variations in speed of decision, and finality of judgment could be measured by noting the time needed to respond to such a multiple choice.

The subjects of the views selected were as follows:

1. In the heart of a banana plantation, Hawaiian Island. (Scene, no persons.)
2. Approach Wall, Gatun Lake and mechanism for towing boats through the docks, Panama. (Mechanical, some persons.)
3. Building the peculiar round boats called "Kufas" on the shore of the Tigris near Bagdad. (Vocational, travel, persons slightly more prominent.)
4. Sudanese native inhabitants of West Java, near Hotel Villa Dolce, Garvet, Java. (Young and old persons of foreign race, travel.)
5. Shops and people on narrow up-hill street of steps in Pera, Constantinople. (Scene, travel, people snapped at their street occupations.)
6. Some of the 4,000 employees in the DeBeers Diamond Mines, Kimberley, South Africa. (Mouth of mine, cars, native black miners watching photographer.)
7. Selling rice, and gossiping with the neighbors—home life of contented citizens of Cashmere. (Foreign natives at work.)
8. Sisikon and the mighty Uri-Rothstock, Switzerland. (Mountain and lake scene, with little town in foreground.)
9. Kikuyo women with water vessels beside village storehouses, East Africa. (Women with water gourds on head.)

10. Montevideo, the capital of Uruguay, from the harbor showing shipping. (Ships, water, with city in background, no persons prominent.)

Method of Procedure

This was the first of the tests given. As soon as the introductory greetings were over, the experimenter pushed the stereoscope with the pictures over to the subject, who uniformly sat opposite him at the testing table, with the question, "You know how to use this glass, do you not?" If the answer was negative, the instrument was briefly described and illustrated. When the subject appeared to understand the use of the materials, the experimenter asked the subject to occupy himself for a little while with the pictures, "while he finished some notes." The subjects were allowed to occupy themselves with the pictures for five minutes. It was originally planned to score the subjects on their mode of procedure, but since it was found impossible to reduce the records to any sound objectively scorable system, the effort was abandoned. The five-minute period was retained, however, since it furnished excellent opportunity for establishing rapport.

After the five-minute interval had passed, the subject was asked to arrange the ten pictures in a series, placing the one he liked best first, the one he liked next best on top of that, and so on through the list. The performance was scored [1] on the basis of the time required to arrange the series. The directions as used by the experimenters follow.

Directions for the Multiple Choice Test

After subject is seated at the table, quietly say to him:

"Excuse me just a moment till I finish this note. Here are some pictures you might enjoy looking at. I would like to know what you think of them."

While saying this, push the scope and ten pictures over toward the subject, one picture in position.

Start stop watch as you do so.

Begin at once to make careful note of subject's behavior.

Note the following items particularly:

a. Number of pictures which are examined without scope.

b. Number which are examined with scope.

[1] It may also be possible later to score this test on the basis of the order of preference for the pictures. The records are available, but it has not yet been possible to carry out this investigation. The pictures were chosen from a wide range of subjects as may be seen from the list above, and the type of view selected may be significant.

c. Number with reference to which remarks are made.

d. Number of irrelevant remarks which are made.

Allow five minutes for the examination of the pictures, then proceed at once to the second test.

(Though the records as above described were not used, they were in every case actually attempted by the examiners.)

Directions for Multiple Choice Scores

As soon as the first "test" has been completed, reset your stop watch and say to your subject:

"Now please arrange these pictures in the order in which you like them best. Don't try to arrange them the way you think other people might like them, but the way you yourself really like them."

Start the stop watch as you complete your directions, and stop it when the last picture has been selected.

Note carefully the following items:

a. Total elapsed time required for the selection.

b. The order of final placement.

c. Any remarks made during the process of selection.

d. Any evidence of emotional reaction.

Should subject fail to understand the first directions, reset stop watch, explain more fully, and start again. Only one reset is to be used. If subject fails to react to the directions, make careful note of his behavior for five minutes, and pass on to the next test.

Scores on Multiple Choice Test

Table XXXVII presents the time scores for arranging the ten pictures in the order in which the subjects "liked them best." There are, as before, three frequency distributions, one for the scores of the introverts, one for those of the extraverts, and the third for the two combined into one group. Plate XVII and Table XXXVIII present the statistical analysis of these scores.

From the findings presented in Table XXXVII and Plate XVII, we may conclude as follows:

a. The distribution of the scores of the introverts shows a marked positive skew. That of the extraverts is also skewed positively, but in a smaller degree. With the exception of one single extravert case, the excessively long time scores are all introvert scores.

b. The variability of the scores of the introverts is 1.1524 times that of the scores of the extraverts.

c. The mean of the scores of the introvert group is 21.553 seconds greater than that of the extravert group. The standard

TABLE XXXVII

THE FREQUENCY DISTRIBUTION OF SCORES ON THE MULTIPLE CHOICE TEST

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Time in Seconds:			
21– 30	..	1	1
31– 40	5	5	10
41– 50	3	14	17
51– 60	8	11	19
61– 70	17	20	37
71– 80	11	10	21
81– 90	10	15	25
91–100	7	4	11
101–110	6	9	15
111–120	7	1	8
121–130	2	4	6
131–140	6	1	7
141–150	5	1	6
151–160	1	1	2
161–170	3	1	4
171–180	2	..	2
181–190	3	..	3
191–200	1	2	3
201–210	..	2	2
211–220	1	..	1
221–230	1	..	1
231–240	1	..	1
241–250	..	..	..
251–260	..	..	..
261–270	1	..	1
271–280	..	..	..
281–290	..	..	..
291–300	1	..	1
301–310	..	..	..
311–320	1	..	1
391–400	..	1	1

error of the difference is 7.174. The experimental coefficient of the difference between the mean scores and its standard error is 3.004. There is accordingly about 1 chance in 1,000 that the difference is due solely to chance errors of selection. The marked skew of both of the distributions must not be forgotten.

PLATE XVII

A Comparison of the Multiple Choice Time Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	87.5	70.5
mean	104.029	82.476
σ distrib.	54.994	47.719
σ mean	5.4186	4.7019

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 21.553
σ difference	= 7.174
Experimental Coefficient	= 3.004
Q	= 1 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 67.43%
σ overlap	= .4378
Experimental Coefficient	= .3981
Q	= 345 in 1,000

d. The overlap is 67.43 per cent. with a standard error of .4378. The chances are 345 in 1,000 that the excess of overlap over that which chance alone would produce will become zero.

Table XXXVIII shows the following trends:

a. The correlations between criterion and test score are small, but consistent and positive. There is apparently a slight tendency for those with a high criterion rank, i.e., the introverts, to be slower in arranging ten pictures in an order of preference than are the extraverts.

b. The correlation of age and test score is very small, negative, and consistent throughout the three groups. The negative age-test score correlation is almost as large as the positive correlation between criterion and test score except in the combined group. Age has little or no relation to speed of arranging pictures with the group here studied.

c. The correlation of intelligence and test score is negligible. A negative correlation would seem reasonable, especially in the

TABLE XXXVIII

THE CORRELATIONS BETWEEN SCORES ON MULTIPLE CHOICE TIME AND THE CRITERION, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	.097 ± .065	.084 ± .065	* .257 ± .057
r_{23}	− .065 ± .066	− .054 ± .066	− .086 ± .046
r_{24}	.039 ± .066	− .105 ± .065	− .085 ± .046

* Coefficients preceded by an asterisk are Biserial r coefficients.

light of the fact that the intelligence test used with both of the groups was one which calls into play a long series of quick choices. Apparently speed of choosing on the basis of logic and speed of choosing on the basis of emotion are not highly correlated.

We may conclude, therefore, that speed of reaching a conclusion on an emotional basis tends to be somewhat slower in introverts than in extraverts. Age has little bearing on this tendency to slow choice, and intelligence a very doubtful one.

The characteristic deserves more careful study, and the technique employed appears to have possibilities beyond those reported here.

CHAPTER IX

MOTIVATED CHOICE AND INTROVERSION-EXTRAVERSION

General Considerations

The experiment with the stereoscope pictures demonstrated a difference in the speed of response when the controlling factor was affect expression. It remained to be seen how the subjects would react to a situation involving a personal motive in making a choice. Marston [8] devised a test involving ten trials in each of which two boxes were presented, of which one contained a toy duck, and the other nothing. Marston concluded that while there were undoubted differences in the implicit responses, no differentiation could be made between introvert and extravert children on the basis of his scores. He recommends an attack upon the problem via the implicit responses.

The earlier experiments described in the preceding pages encouraged us to make a new attack, using objective time scores. A test was therefore developed with the hope of laying bare differences in the tendency toward blocked choices when self-interest was definitely involved. The technique of the test was as follows:

Directions for Motivated Choice Test

Provide five cards, one of which is a king. Cover them in such manner that subject cannot examine them or make an unconscious selection. Place a five-cent piece on the table with these words:

"One of these cards is a king—you are to pick one of these cards. If you pick a king card you are entitled to this nickel. Are you ready? Go!"

Present the cards and at the same time start your stop watch. Stop the watch as soon as your subject has made his choice and record the time.

After the card selected in the first trial has been examined, return it to the table. Cover again, carefully shuffle the cards and say:

"Now we will try this again. Are you ready? All right, go!"

Again record the time required to make the choice. Proceed at once to the third trial in the same manner.

Your subject has a chance to earn three nickels, which are to be paid to him promptly after each successful choice. Shuffle the cards carefully after each choice, and see that there are no tell-tale marks on them.

The crucial point in the test is to see how your subject reacts to motivated suspense and uncertainty. Therefore record carefully:

a. The exact time for each of the three trials.
b. Any remarks made during or after the test.
c. Any sign of emotional stress, especially of disappointment.
d. Any difference of attitude as compared with the choice made in the multiple choice test.

Note: At first envelopes were used, containing a token, but after examining a few of the children it was found that fingermarks on the envelopes served as tell-tale marks. The envelopes were therefore discarded in the case of all the Kansas City children, and playing cards used instead. The balance of the test remained unchanged. The mean time of selection was not altered by the change.

Motivated Choice Scores

It may be objected that the motivating power of a five-cent piece would vary enormously with the economic and social status of the child being tested. The objection is valid, but any other motive would be similarly unequal in its stimulating power. As a matter of fact the response of the subjects to the nickel varied markedly, from a smiling rejection of the proffered nickel through a matter-of-fact acceptance of "winnings" to an indignant refusal to participate in an activity which so strongly resembled "gambling." It was found impossible to score these "indicators of emotion" and of attitude in any effective manner.

Using the sum of the times of the three trials, scores were developed, which are presented in Table XXXIX. Plate XVIII and Table XL give a summary of the statistical interpretation of these scores.

From a study of Table XXXIX and of Plate XVIII, the following trends would seem worthy of note:

a. The distributions of both introvert and extravert scores are positively skewed. It is apparent that some disturbing cause is at work in both groups, producing a rather marked distortion in the direction of lengthened time. The distortion is most marked at the extreme upper end of the scale in the case of the introvert scores.

TABLE XXXIX

THE FREQUENCY DISTRIBUTION OF SCORES ON MOTIVATED CHOICE TIME

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Time in Seconds:			
2– 4	3	9	12
5– 7	24	31	55
8–10	22	23	45
11–13	20	13	33
14–16	11	8	19
17–19	4	4	8
20–22	2	5	7
23–25	6	4	10
26–28	2	1	3
29–31	2	..	2
32–34	..	2	2
35–37	..	..	..
38–40	..	..	..
41–43	..	..	..
44–46	1	1	2
47–49	1	..	1
50–52	..	..	..
53–55	1	..	1
56–58	..	..	..
59–61	..	1	1
62–64	..	..	..
65–67	..	..	..
68–70	1	..	1
71–73	..	..	..
74–76	..	1	1
77–79	1	..	1
80–82	1	..	1
83–85	..	..	..
86–88	..	..	..
89–91	1	..	1

b. The variability of the scores of the introvert group is 1.4616 times as great as that of the scores of the extravert group.

c. The difference between the means of the contrasted groups is 3.408, with a standard error of 1.861. The reliability of all derivatives of these values is weakened by the skew of the distributions from which they are derived. The experimental coefficient of the difference between the means is 1.831, with a

PLATE XVIII

A Comparison of the Motivated Choice Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	10.375	8.500
mean	14.966	11.558
σ distrib.	15.5899	10.666
σ mean	1.5361	1.0509

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 3.4078
σ difference	= 1.8612
Experimental Coefficient	= 1.8309
Q	= 43 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 63.11
σ overlap	= .148
Experimental Coefficient	= .8816
Q	= 189 in 1,000

probability of 34 chances in 1,000 that the difference is not a reliable one.

d. The overlap is 63.11 per cent with a standard error of .1487, an experimental coefficient of .8816, and a probability of 189 chances per 1,000 that the overlap is due to chance factors alone.

Table XL suggests the following trends:

a. The correlations between criterion and motivated choice score are small, but large enough to be indicative of a tendency in the case of the introvert group. The introverts apparently tend slightly to choose more cautiously as their criterion scores go down, i.e., as they become less introverted. The extravert group still preserves the tendency, but only to a vanishing degree. The less markedly introverted cases enter more wholeheartedly into the situation. The tendency is, however, only hinted at by the correlation of $-.133 \pm .065$. The correlation

TABLE XL

THE CORRELATIONS BETWEEN MOTIVATED CHOICE TIME SCORES AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	$-.133 \pm .065$	$-.015 \pm .066$	$*.159 \pm .058$
r_{23}	$-.021 \pm .066$	$.021 \pm .066$	$.001 \pm .047$
r_{24}	$-.173 \pm .065$	$-.038 \pm .066$	$-.181 \pm .045$

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

of the combined group shows a reversing trend. An inspection of the scattergram raises the question whether the relation is not really curvilinear, trending toward a U-shaped curve rather than a straight line.

b. The correlations between age and motivated choice score are negligible, and practically approach zero.

c. The correlation of intelligence with test score is negative, and, in the case of the introvert and the combined groups, large enough to suggest the presence of a real trend. The brighter children have a tendency to react more quickly than the duller ones. It must be borne in mind, however, that it was precisely this tendency to react quickly that entered into the production of high intelligence scores. The tendency toward a negative correlation is present with the extravert group also, but to a much smaller degree. The probable errors in each case are so large as to make the difference quite unconvincing.

There is no convincing difference in the speed with which introverts react to a motivated choice situation like that presented in this test when compared with extraverts. Undoubtedly, introverts do tend to hesitate somewhat longer, but the difference in central tendency is not large enough to be statistically convincing, though practically it may be of interest.

Age is not a factor in speed of choosing, either in the case of introverts or of extraverts. Intelligence plays a larger part in

affecting speed in motivated choice than does age, more especially in the case of the introvert group.

Supplementary Considerations

The results above presented deal only with the objective element of time scores. There were, however, other elements in the response which merit consideration. They have not been statistically considered because no method was available for reducing them to a reasonably objective basis. There were interesting individual differences in the quality of the responses. A typical picture is presented in Table XLI.

TABLE XLI

Qualitative Differences in Reaction to the Motivated Choice test Situation

Qualitative Trends	Introverts	Extraverts	Total
A. *Work Method*			
1. Work by plan or formula	37	45	82
2. Work by chance alone	66	58	124
B. *Attitude Toward Winnings*			
1. Resent request to "gamble"	1	1	2
2. Decline to accept winnings	9	7	16
3. Pocket winnings without question	25	36	61
C. *Emotional Display*			
1. Laugh or smile broadly, win or lose	33	62	95
2. Talk or make gestures	21	58	79
3. Make no sign of emotion	14	9	23
4. Smile rather faintly	44	20	64
5. Show disappointment	7	5	12

From the data roughly reported in Table XLI, the following facts are indicated:

a. There is no convincing difference between the introvert and extravert group as to method of attack upon the problem set in the test. A slightly larger proportion of extraverts enters into the situation heartily enough to devise and follow a plan of selection. The difference is not great enough to be significant. By the method of unlike signs, $r = .125$.

b. A violent conditioned response of hostility to a game of chance may appear occasionally in either type of child. In this particular case the response of the extravert child was accompanied by violent flushing and gestures which appeared with explosive suddenness, but disappeared when the offer of the coin was withdrawn. In the introvert case, the scruples were more deep-seated and attached to both the cards and the coin. The subject finally coöperated to the extent of gingerly drawing the card, but shrank in evident distress from the proffered coin, pleading home training and religious convictions. The response was distinctly less explosive than in the case of the extravert. Both cases were boys.

c. There is no significant difference in the willingness of those of the two groups who won coins to pocket their "winnings."

d. There is a distinct tendency for members of the extravert group to respond more frequently by frank hearty laughter or broad smiles, excited gestures, exclamations, or spontaneous remarks of a more or less frank nature than was found in the case of the members of the introvert group. If these manifestations could be objectively and reliably scored, they would probably have definite diagnostic significance.

e. There was a more marked tendency for the introvert cases to give no objective sign of emotion than was the case with the extraverts.

f. The introverts smiled the "sweet lemon smile," or displayed traces of disappointment somewhat more often than was the case with the extraverts, though the difference was not convincingly large.

We may therefore picture the introvert as an individual in whom behavior is slightly retarded, suppressed perhaps in some of its more spontaneous phases, while the extravert is unhampered by whatever it is that conditions the deliberation of the introvert. Unchecked spontaneity versus restrained deliberation pictures the general trend as it came to light in this study.

CHAPTER X

BOX SELECTION AND INTROVERSION-EXTRAVERSION

General Considerations

Travis [12], Morgan [13], and McDougall [5] believe that suggestibility is a trait of extraverts, and that it is markedly missing in introverts. Although Brown [63] casts some doubt on the existence of general suggestibility, yet the idea seemed to have merit, and it was decided to attempt a study of some aspects of the problem.

Many of the techniques for discovering and measuring suggestibility involve complicated mechanical provisions. Most, if not all, at some point involve the factor of personal prestige, which Aveling and Hargreaves [64] have shown to be an important element in suggestibility, and practically all of them offer difficulties in securing objective results.

The writer has in his own practice often used the weighted cubes of the Stanford Binet Series [1] as a test of one form of suggestibility and finality of judgment. It would seem reasonable to assume that if a subject were presented with a group of identically weighted cubes and were asked to arrange them in a row according to their weight, after being assured that there was a slight difference in weight between them, the easily suggestible person would complete the task more quickly and with a greater air of finality than would a counter-suggestible person. A test of this sort was accordingly devised and administered.

Two sets of scores were developed. The first consisted of the time required to arrange the boxes in a row. Three trials were given and the three times were added to give one time score.

The second score, less objective by far, consisted of an evaluation of the attitude and by-play of the subject while he was doing his work and immediately after. A record was kept of all remarks and supplementary displays of thought or emotion, and

[1] Stanford Binet Test IX:2.

at the end the subject was asked how certain he was of his arrangement of the materials submitted. A composite suggestibility score was built up out of these items.

1. Box Selection Time Scores

DESCRIPTION OF TEST

Three round tin boxes, weighted to weigh exactly fifteen grams each were provided. The boxes were alike in form and color, and bore no distinguishing marks. The directions used in giving the test are given here. The first scores secured were time scores. The question to be answered was, do introvert or extravert children take a longer time to adjust to a situation such as has been pictured, or is there no difference?

Directions for Box Comparison Time

Set your stop watch, quietly place the three boxes in a row before your subject and say:

"Here are three boxes that look exactly alike. They weigh almost alike too, but there *is* a slight difference between them. No two of them weigh exactly the same. Won't you please arrange them for me in a row according to their weight?"

Start your stop watch with the last word. Stop it when subject has concluded the assigned task. Note the time.

Three trials are to be given, each timed as the first one was.

Start the second trial by quietly mixing the boxes and saying:

"We will try this once more, and see whether we can do any better. There *is* a difference."

After each trial go through the motions of verifying your subject's arrangement if he made one.

Record the time for each trial separately. Score is the sum of the three times.

THE SCORES

Table XLII presents the box comparison time scores arranged as before in three frequency distributions; one of the scores of the introverts, one of the scores of the extraverts, and the third of the two combined into one. Plate XIX and Table XLIII give the result of the statistical interpretation of these data.

The data of Table XLII and of Plate XIX when carefully studied reveal some interesting trends:

a. The curve of both the introvert and extravert scores is skewed positively. The distribution of the scores of the extra-

TABLE XLII

THE FREQUENCY DISTRIBUTION OF SCORES ON BOX SELECTION TIME

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Time in Seconds:			
11– 20	3	1	4
21– 30	6	5	11
31– 40	8	11	19
41– 50	15	14	29
51– 60	9	10	19
61– 70	10	12	22
71– 80	11	7	18
81– 90	9	8	17
91–100	6	5	11
101–110	5	11	16
111–120	2	4	6
121–130	4	2	6
131–140	2	1	3
141–150	1	1	2
151–160	1	3	4
161–170	1	2	3
171–180	1	..	1
181–190	1	4	5
191–200	..	..	..
201–210	1	..	1
211–220	..	..	..
221–230	2	..	2
231–240	..	..	..
241–250	1	..	1
251–260	..	..	..
261–270	..	..	..
271–280	1	..	1
281–290	2	..	2
291–300	..	..	..
301–310	..	..	..
311–320	..	1	1
321–330	..	..	..
331–340	..	1	1
471–480	1	..	1

verts presents two excessively slow cases which are probably not typical of the group of which they form a part. They exaggerate the extravert skew, and otherwise disturb the comparison.

b. The variability of the scores of the introverts as measured

PLATE XIX

A Comparison of the Box Selection Time Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	70.455	68.75
MEAN	87.621	82.476
σ distrib.	68.902	53.729
σ mean	6.789	5.294

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 5.1456
σ difference	= 8.6092
Experimental Coefficient	= .5977
Q	= 274 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 51.699%
σ overlap	= .521
Experimental Coefficient	= .0032
Q	= 499 in 1,000

by the sigmas of the scores is 1.282 times that of the extraverts. The practical range of the scores of the extraverts is one hundred seconds smaller than that of the contrasted group of introverts.

c. The mean score of the introvert group is larger than that of the extravert group. The difference between the two means is 5.1456, with a standard error of 8.609. The difference between the two means has been constricted by the adventitious cases mentioned. In like manner, the standard error of the difference has been expanded. The experimental coefficient of the difference is .598, implying 274 chances in 1,000 that the difference is only a chance difference.

d. The overlap is 51.70 per cent with a standard error of .5241, suggesting but 501 chances in 1,000 that this overlap is a reliable proportion. The reliability of difference between the means and the reliability of overlap are disturbed by the marked skew of the distributions, and by the presence of what are possibly not typical cases in the extravert group.

TABLE XLIII

THE CORRELATIONS BETWEEN SCORES ON BOX SELECTION TIME AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	.302 ± .060	− .018 ± .066	*.054 ± .058
r_{23}	− .02 ± .066	.074 ± .066	.045 ± .046
r_{24}	.081 ± .066	.001 ± .067	.031 ± .046

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

The facts shown in Table XLIII are of interest:

a. Consideration of the correlation between criterion and box comparison time scores may make clear the reason for hesitating to accept the reliability of the relationships so far noted. The scores of the introverts show a correlation of .302 between criterion and box comparison time scores. The scores of the extraverts show a corresponding correlation of —.018, or substantially no correlation at all, a state of affairs which shows a difference of .320, with a probable error of .089 and a probability of only 1 chance in 10,000 that it is not a true difference. There is therefore some show of reason in suspecting that some of the cases referred to in Table XLII are adventitious cases. Contradictory factors apparently tend to produce a reversal of relationship. As we shall see directly, these contradictory factors are probably neither those of age nor those of intelligence.

b. The correlation of age and box selection time is small as to quantity and variable as to quality. The coefficients so nearly approach zero as to have little or no significance.

c. Almost the same statement may be made with reference to the correlation of intelligence and box selection score. The correlation is negligible.

We may safely conclude that there is no convincing difference in the speed with which introverts and extraverts of the groups

here studied react to the box comparison problem. The introverts tend to be slower but some of the extraverts, assuming that they are such, find themselves so puzzled by the situation that they too expand their reaction time, and obliterate the reliability of the observed difference. Neither age nor intelligence is clearly a function of the speed of response within the limits occurring in the present study.

2. Box Weight Suggestibility

GENERAL CONSIDERATIONS

From the materials presented in Table XLII, it appears that of the two hundred and six cases included in this study not one failed to respond to the request to arrange the three boxes according to their weight. As may be seen by examining the time records, some of the subjects took very much more time than others, but sooner or later all of them did as they were requested. Some perhaps responded as a matter of complacency, many of them probably because they actually thought they detected a difference. Unfortunately, there was no objective way in which the two types of response could be certainly and objectively separated.

DIRECTIONS FOR SCORING

Testers were asked to watch their subjects carefully, keeping the following key in mind, and scoring each trial as there directed.

Key for Scoring Suggestibility

Response may be one of the following:

(*a*) Subject detects a difference, and arranges boxes as requested. Score 5.

(*b*) Subject doubts the existence of a difference, but thinks he may be at fault. Score 3.

(*c*) Subject quietly denies the existence of any difference in weight. Score 1.

(*d*) Subject emphatically and more or less resentfully denies the existence of any difference. Score 0.

After completing the third trial, the subject was in each case asked how sure he was of his arrangement, and a verbatim record made of his reply. The score on quality of suggestibility was later checked by the writer in terms of this record. It is unlikely

that the scoring gained much in objective accuracy by this process, and the report on this phase of the study is presented with this limitation frankly recognized.

BOX WEIGHT SUGGESTIBILITY SCORES

Table XLIV presents the "box weight suggestibility" scores in the form of three frequency tables as before. Plate XX and Table XLV show the results of the statistical study of these data.

TABLE XLIV

THE FREQUENCY DISTRIBUTION OF SCORES ON BOX WEIGHT SUGGESTIBILITY

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Suggestibility Scores:			
5	..	..	..
6	2	2	4
7	..	2	2
8	..	..	..
9	2	4	6
10	1	..	1
11	2	2	4
12	46	13	59
13	3	1	4
14	4	12	16
15	43	67	110

From the data and relationships mentioned in Table XLIV, and in Plate XX, the following facts appear.

a. Both curves show a marked negative skew, that of the introverts somewhat less so than that of the extraverts. Clearly some selective factor is involved.

b. The variability of the extravert distribution is 1.127 times that of the introvert. The range of the two distributions is identical.

c. The difference between the mean scores of the two contrasted distributions is .699, and the standard error of this difference is .2794. The exaggerated skew of the distribution makes both the measures of central tendency and consequently the difference between them of doubtful significance. The ex-

PLATE XX

A Comparison of the Box Weight Suggestibility Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	11.967	14.231
mean	12.646	13.345
σ distrib.	1.887	2.117
σ mean	.1859	.2087

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= .6990
σ difference	= .2794
Experimental Coefficient	= 2.502
Q	= 62 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 32.08%
σ overlap	= .048
Experimental Coefficient	= 3.270
Q	= 1 in 1,000

perimental coefficient of the difference between the means and of its standard error is 2.502, which implies 62 chances in 1,000 that the difference is due to chance error.

d. The overlap is 32.08 per cent. with a standard error of .0548. The experimental coefficient is 3.270, and the chances are only 1 per 1,000 that the overlap is merely a chance overlap.

The facts of Table XLV are of interest:

a. The correlations between criterion and test scores are variable as to both sign and quantity. The range on one scale was narrow and markedly skewed. The results are inconclusive, though a negative correlation is indicated. Apparently low criterion ratings tend slightly to be accompanied by high scores on box weight suggestibility. The method of scoring was crude, and for that reason no comparison with Travis' findings is here made. Certainly no positive confirmation of the non-suggestibility of introverts is here involved.

b. The correlation between age and test score is consistently

TABLE XLV

THE CORRELATIONS BETWEEN SCORES ON BOX WEIGHT SUGGESTIBILITY AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	− .121 ± .065	.006 ± .067	*− .216 ± .057
r_{23}	− .182 ± .064	− .214 ± .063	− .216 ± .043
r_{24}	− .053 ± .066	− .095 ± .065	− .039 ± .047

* Coefficients preceded by an asterisk are Biserial r coefficients.

negative, and large enough to indicate some trend. Older children are, on the whole, a bit more sophisticated and yield less readily to the suggestion as given. But the extravert group seems, if anything, more inclined to become cautious with advancing years than does the introvert group, which is precisely the opposite of what Travis would lead us to expect.

c. The correlation of intelligence with box weight suggestibility scores is consistently negative and smaller than that shown above for age and test score.

The consideration of box weight suggestibility scores and correlations is rendered unsatisfactory because of the unreliability of the scores. Age appears somehow to be a factor, but age itself is hardly correlated with the criterion. Intelligence hardly seems to be a factor. The experiment warrants further trial with a more effectively developed scoring technique.

On the face of the findings here discussed, it is unwarranted to say that extraverts are suggestible and introverts are not. It would be fairer to say that the young members of both groups tend to be more suggestible in this type of situation than are the older ones, and that there is concurrently a slight tendency for those with lower criterion ratings to have higher test scores.[1]

[1] It seemed inadvisable to carry out the obvious study of correlation of Box Selection Time scores and Box Weight Suggestibility scores until better scores are available.

CHAPTER XI

PICTURE QUESTIONS AND INTROVERSION-EXTRAVERSION

General Considerations

Some years of experience with the Binet test had led to the conclusion that there was a marked difference between individuals in the matter of the tenacity with which memory images withstood subsequent distortion by means of questions and insinuations. The reactions imply a type of suggestibility quite different from that which was called into play in the box choice technique previously discussed, but closely similar to the conditions found in the "Aussage Test" [65] and in cross-questioning. From a general study of the concepts of introversion and extraversion, it seemed that the tendency toward "fabulation" would possibly be more markedly present in extraverts than in introverts. The following test was accordingly administered to each member of both test groups.

Directions for the Picture Question Test

Present the Dutch Home picture [1] to your subject with these words:

"Tell me about this picture, please."

If subject asks what you want to know about the picture, say, "Anything you like. Just tell me about the picture."

In one minute, remove the picture with the words:

"That was good. You remember now that the picture was about a Dutch home; that a mother had just punished her child for doing something wrong. You remember too that it was summer, because one of the windows was open, and the curtain was blowing. You remember the room, do you not? All right, now tell me on which end of the table was the bread knife?"

When subject replies, record the answer. Continue at once with the remaining four questions. The five questions asked were as follows:

1. On which end of the table was the bread knife?
2. How many little kittens were under the mother's chair?

[1] The Dutch Home picture here referred to is one of the pictures used in the Stanford revision of the Binet test.

3. On which side of the room was the grandfather's clock?
4. How many children were out near the windmill?
5. In front of which window was the flower?

Do not enter into any discussion with your subject. Simply counter any doubt with the statement: "The test is a memory test, and I can't discuss it with you."

Allow a reasonable time, not over *one minute* in any case, for reflection, and then ask, *"Don't you remember?"*

Score as follows:

a. "There was no such item in the picture," or any flat rejection of the suggestion. Score 1.

b. "I don't remember seeing anything like that in the picture," or "I may have forgotten, but I don't think there was such an item." Score 2.

c. "I can't remember whether there was or wasn't," or any expression of unprejudiced doubt. Score 3.

d. "I just vaguely remember something like that, but I can't remember exactly." Score 4.

e. A positive answer accepting the suggestion substantially in full. Score 5.

Score each item separately.

Be sure to read each of the questions in a serious, positive, matter-of-fact manner. Practice is necessary for success.

Record any tendency toward suspicious negativistic rejection of the suggestions, or a marked tendency toward compliance.

It may be objected that three or more pictures should have been used in order to make the findings conclusive. The criticism is sound. Only one picture was used, however, because it was intended that the present inquiry should be a preliminary survey, to be followed over a period of time by a more searching investigation of such trends as an exploratory study might reveal.

It may also be objected that a test of the present type depends for its utility too largely on the sex, age, and personal forcefulness of the experimenter. Aveling and Hargreaves [64] found that "prestige" and sex were always complicating factors in any situation involving direct verbal suggestion. They detected both suggestion and counter suggestion, or negativism, and concluded that the curve of results was a bimodal U-shaped one. The validity of the criticism will be discussed later.

From the responses to the test described above, scores were developed, consisting of the sum of the scores earned on each one of the five questions asked. The results are presented in Table XLVI in the form of three frequency distributions, and in

TABLE XLVI

THE FREQUENCY DISTRIBUTION OF SCORES ON PICTURE QUESTIONS

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Suggestibility Scores:			
4	..	..	..
5	..	2	2
6	..	2	2
7	4	2	6
8	1	..	1
9	4	1	5
10	4	5	9
11	6	1	7
12	6	4	10
13	9	7	16
14	10	13	23
15	8	8	16
16	8	7	15
17	7	13	20
18	7	6	13
19	10	15	25
20	5	3	8
21	4	3	7
22	4	3	7
23	1	3	4
24	1	3	4
25	4	2	6

Plate XXI and Table XLVII, which contain the results of the statistical interpretation of these data.

These data and interpretations suggest the following:

a. Both distributions are approximately normal.

b. The variability of the two contrasted distributions is substantially the same. The sigma of the introverts is 1.009 times that of the extraverts.

c. The mean of the scores of the extraverts is only slightly larger than the mean of the scores of the introverts. The difference between the means is .426, with a standard error of .6088. The experimental coefficient of the difference is .702. In other words, there are about 242 chances in 1,000 that the observed difference between the two means is not a reliable one.

PLATE XXI

A Comparison of the Picture Question Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	14.938	15.929
MEAN	15.121	15.549
σ distrib.	4.389	4.3497
σ mean	.4325	.4286

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= .4272
σ difference	= .6089
Experimental Coefficient	= .7016
Q	= 242 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 42.31%
σ overlap	= .060
Experimental Coefficient	= 1.2016
Q	= 115 in 1,000

d. The overlap is 42.31 per cent. with a standard error of .064. The experimental coefficient of the overlap is 1.202. There are 115 chances in 1,000 that the overlap is not based on a real difference.

The correlations of Table XLVII indicate the following trends:

a. The correlations of the criterion with suggestibility as measured by the picture question scores are so small as to be practically without significance. The slight indications that exist are of contradictory nature and are not maintained when the groups are combined.

b. The correlation of age with picture question score is contradictory. The introvert group shows a slight trend toward a negative correlation, but the extravert group reverses the trend as to quality, and shows but a small correlation.

c. The correlation of intelligence with picture question score is consistently negative but variable as to quantity. In the case

TABLE XLVII

THE CORRELATIONS BETWEEN SCORES ON PICTURE QUESTIONS AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	− .010 ± .066	.075 ± .066	*− .061 ± .057
r_{23}	− .108 ± .065	.054 ± .066	− .055 ± .046
r_{24}	− .257 ± .062	− .006 ± .067	− .124 ± .045

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

of the introvert group, there is some trend toward a significant correlation. The brighter children have the low scores. The extravert group shows practically a zero correlation. As many bright cases as dull ones have high suggestibility scores.

It would appear, therefore, that in so far as the procedure employed in this test measures a tendency toward suggestibility, either general or specific, neither the introverts nor the extraverts show any certain trend. Intelligence is apparently a larger factor in determining correlation than is age, though neither is a markedly potent function. It is possible that the element of "personal prestige" mentioned by Aveling and Hargreaves operated to disturb the situation. Part of the testers employed were more positive and certain of voice control than the rest, and it would appear from study of the records that a positive manner tended to produce the higher scores in this test. The records do not permit any objective evaluation. It is, however, suggested as a probable complicating factor.

In any case, a tendency to respond positively to constructive verbal suggestions is quite as characteristic of introverts as it is of extraverts, and of introverts and extraverts at all levels of criterion rating. Both fabulate about equally well, quite apart from age and intelligence.

The tendency may be the direct expression of an habitual com-

placency in the presence of a school situation, and, in that case, may be the result of training which has more or less obliterated, not only an original difference, but also the habit of critical thinking, and of honest criticism.

Summary of the Study of Suggestibility

We may conclude from the facts before us that in so far as the responses considered in Chapters XIV and XV measure suggestibility, introverts show a slight tendency to be somewhat less suggestible than extraverts. They require a somewhat longer time to complete the response to their own satisfaction and are more likely to retain a certain measure of uncertainty and doubt with reference to the matter.

Intelligence is apparently not a prominent function in either of the two responses measured.

Age brings experience, and experience tends to produce caution, though only in a slight degree, if one may judge by the results of this study.

CHAPTER XII

COLOR-NAMING AND INTROVERSION-EXTRAVERSION

General Statement

The standard color-naming test described by Wissler [66] and standardized by Woodworth and Wells [67] shows "periods of hesitation and obstruction, even of false reaction," which the authors ascribe to a species of interference or mutual blocking. It seemed that the phenomenon might be significant for the purposes of this inquiry. Accordingly, copies of the standard color sheet were secured, and the test administered according to the instructions below. Two trials were given, the whole test being given each time.

Directions for the Color-Naming Test

Present the Color-Naming sheet,[1] point to the sample squares, and ask the subject to name the five colors shown there.

After the subject has demonstrated his ability to recognize the colors, proceed as follows:

Set stop watch, expose the color squares, and say:

"When I say 'Ready? Go!' I want you to start to name all these little squares of color for me just as they come. Do it just as fast as you can. Name them all just as they come. Don't skip any. Are you ready? Go!"

Start the stop watch at the signal, and stop it at the moment the last square is named. Record the time. Next turn the blank on its side and say:

"Now let's try it once more. Just as fast as you can. Are you ready? Go!"

Start stop watch at the signal, and stop it as soon as the task is done.

Record any emotional display, and any other striking behavior.

In case your subject is color-blind and is unable to distinguish the colors, use the geometric design sheet, following exactly the same process, except that the terms used will have to be changed.[2]

Record the time for each trial separately.

[1] The standard color-naming sheet described by Woodworth and Wells was used in this test.

[2] No color blind cases appeared, and the substitution of the geometrical design sheet was not necessary. All cases used the color-naming test.

Scores for Color-Naming Time

On the basis of the performance thus carried out, three scores were developed; time for the first trial, time for the second trial, total time for both trials. The attempt was made to score on the place where the blocking began, but it proved impossible with only one experimenter observing, to check reliably on time, blocking, and correctness, because, while notes were being made, the subject was responding to the next color squares, which in turn needed attention. With all the experimenters, however, the rather definite impression gained ground, that the extravert group showed the subjective interference sign somewhat earlier and more persistently than the introverts, who, on the whole, were somewhat more collected and regained control more readily if they did lose it. The "interference index" has been studied by Garrett and Lemmon [68], but the method proposed, when tested on a preliminary sample, did not produce reliable results and was rejected in consequence. Wells and Currie [69], using a geometrical design substitution test with psychotic patients, suggest that the work curve method of approach gives access to the volitional status of the subject. The method of timing the performance of each line, however, proved unsuccessful in this study, and though it seemed to have diagnostic value in approaching dementia praecox, had to be abandoned in order to secure such qualitative data as were referred to in discussing the interference phenomenon.

Because of certain differences in the score a separate study was made of the time for each of the two trials and for the total time.

The unscorable by-products of reaction to this test will be discussed following the presentation of the data of total time.

1. first trial: color-naming time

Table XLVIII shows the distributions of time scores for the first trial on the color-naming test. The time is indicated in tenths of seconds. Plate XXII and Table XLIX show the results of the statistical interpretation of these scores.

From Table XLVIII and Plate XXII, the following facts may be seen:

a. Both of the contrasted distributions are substantially symmetrical.

TABLE XLVIII

THE FREQUENCY DISTRIBUTION OF SCORES ON COLOR-NAMING TIME—FIRST TRIAL

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Time in Tenths of Seconds:			
41– 45	1	..	1
46– 50	2	..	2
51– 55	4	10	14
56– 60	9	9	18
61– 65	6	13	19
66– 70	12	20	32
71– 75	21	15	36
76– 80	14	10	24
81– 85	14	10	24
86– 90	8	3	11
91– 95	1	7	8
96–100	3	..	3
101–105	3	4	7
106–110	1	..	1
111–115	2	1	3
116–120	1	..	1
121–125	..	..	..
126–130	..	..	..
131–135	..	..	..
136–140	..	1	1
141–145	..	..	..
146–150	..	..	..
151–155	..	..	..
156–160	..	..	..
161–165	..	..	..
166–170	..	..	..
171–175	..	..	..
176–180	..	..	..
181–185	1	..	1

b. The variability of the introvert group is 1.215 times as great as that of the extravert group.

c. The mean of the introvert group is 3.64 larger than that of the extraverts. The standard error of the difference is 2.264. The experimental coefficient of the difference between the means is 1.608. There are 55 chances in 1,000 that there is only a chance difference between the groups.

PLATE XXII

A Comparison of the Scores Made by a Group of 103 Introverts on Color-Naming Time, First Trial, with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
median	74.1666	69.875
mean	76.0922	72.452
σ distrib.	17.7416	14.606
σ mean	1.7481	1.4392

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 3.6408
σ difference	= 2.2643
Experimental Coefficient	= 1.608
Q	= 55 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 78.35%
σ overlap	= .235
Experimental Coefficient	= 1.2246
Q	= 110 in 1,000

d. The overlap of the two distributions is 78.35 per cent with a standard error of .2315. There are 110 chances in 1,000 that the overlap does not represent a real difference in trend between the two groups.

From Table XLIX, we learn the following facts:

a. The correlation between criterion and test score in the case of all the groups is positive. That of the introvert group is substantially zero, however, while that of the extravert group is .154. The combined group coefficient does not quite reach .15. Whatever of correlation there appears to be between criterion and the score on the first trial of color-naming is due to a slight tendency of the slower extraverts to have the lower criterion ratings. The less the subject is extraverted, the slower the color-naming. The tendency, however, all but disappears when the introvert group is reached. The scattergram suggests an L-shaped curve, with a point at which further decrease of extravert trend has no further effect on the score.

TABLE XLIX

THE CORRELATIONS BETWEEN SCORES ON COLOR-NAMING TIME, FIRST TRIAL, AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	.014 ± .066	.154 ± .065	* .148 ± .058
r_{23}	− .309 ± .058	− .347 ± .058	− .33 ± .042
r_{24}	− .273 ± .062	− .200 ± .062	− .327 ± .042

* Coefficients preceded by an asterisk are Biserial r coefficients.

b. The correlation of age and color-naming score is consistently negative, and is about —.30 in all three groups. Speed tends to be in inverse ratio to age. Woodworth's report does not call attention to this correlation between age and color-naming time.

c. The correlation of intelligence with the score on the first trial of color-naming is likewise negative, and also tends to be about —.30. The less intelligent the subject is, the faster seems to be the trend.

2. SECOND TRIAL: COLOR-NAMING TIME

The second trial on color-naming followed the first trial at once. Table L shows the distribution of scores on the second trial of color-naming in tenths of seconds. Plate XXIII and Table LI present the results of the statistical interpretation of the data presented in Table L.

Study of Table L and of Plate XXIII in the main supports the findings shown in connection with the first trial:

a. The skew of the two distributions is now practically the same and slightly larger.

b. The variability of the introvert scores is practically unchanged, that of the extravert group has grown. The ratio is now 1.05. The effective range is about the same.

TABLE L

THE FREQUENCY DISTRIBUTION OF SCORES ON COLOR-NAMING—SECOND TRIAL

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Time in Tenths of Seconds:			
46– 50	3	1	4
51– 55	2	5	7
56– 60	9	9	18
61– 65	3	13	16
66– 70	11	9	20
71– 75	21	20	41
76– 80	9	3	12
81– 85	10	16	26
86– 90	11	11	22
91– 95	5	4	9
96–100	3	3	6
101–105	4	3	7
106–110	5	2	7
111–115	2	1	3
116–120	2	..	2
121–125	1	1	2
126–130	..	1	1
131–135	..	..	..
136–140	..	1	1
141–145	1	..	1
146–150	..	..	..
151–155	..	..	..
156–160	..	..	..
161–165	..	..	..
166–170	..	..	..
171–175	..	..	..
176–180	..	..	..
181–185	..	..	..
186–190	..	..	..
191–195	..	..	..
196–200	..	..	..
201–205	..	..	..
206–210	..	..	..
211–215	..	..	..
216–220	..	..	..
221–225	1	..	1

PLATE XXIII

A Comparison of the Scores Made by a Group of 103 Introverts on Color-Naming Time, Second Trial, with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	76.3888	73.5125
MEAN	79.6359	76.6748
σ distrib.	17.6206	16.6357
σ mean	1.7362	1.6391

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 2.9612
σ difference	= 2.3877
Experimental Coefficient	= 1.2402
Q	= 108 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 58.49%
σ overlap	= .2229
Experimental Coefficient	= .3809
Q	= 352 in 1,000

c. The difference between the two means is 2.9612″ with a standard error of 2.3877. The experimental coefficient of the difference and of its standard error is 1.240. The chances are 108 in 1,000 that the difference rests on a basis of chance errors.

d. The overlap is now only 58.49 per cent, a loss of 19.86 per cent. The standard error of the second trial overlap is .2229, yielding 352 chances per 1,000 that the overlap is not significant.

The facts of Table LI show the following trends:

a. The correlations between criterion and test score have undergone only slight changes, all within the limits of 1 P.E.

b. The correlations of age and intelligence with the test score are not greatly changed, except that they have become slightly larger, especially so in the case of intelligence. They remain uniformly negative. The expansion is particularly clear in the case of the introvert group, where they may be thought of as definitely significant.

TABLE LI

THE CORRELATIONS BETWEEN SCORES ON COLOR-NAMING TIME, SECOND TRIAL, AND CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	.056 ± .066	.110 ± .065	* .108 ± .058
r_{23}	− .405 ± .043	− .309 ± .060	− .312 ± .043
r_{24}	− .397 ± .056	− .315 ± .060	− .348 ± .042

* Coefficients preceded by an asterisk are Biserial r coefficients.

3. COLOR-NAMING TOTAL SCORE

Combining the time scores of the first and second trials furnishes a new series of scores, which is the basis of Table LII. Plate XXIV and Table LIII show the interpretations of Table LII.

Referring to Table LII and to Plate XXIV, the following facts appear:

a. The curves of the total time distributions are on the whole more symmetrical than those of either the first or the second trials.

b. The variability of the introvert group is 1.388 times that of the extravert group. The extraverts are more consistent with each other than the introverts in all three scores.

c. The mean score of the introvert group is larger by 8.155 seconds than that of the extravert group. The difference has a standard error of 4.825 and an experimental coefficient of 1.690. The chances are 46 in 1,000 that the difference is a chance difference.

A comparison of the reliability of the difference between the means in each of the three series of scores on color-naming indicates that the difference is only slightly more reliable when the two trials are added than when only one trial is used.

Reliability of Mean Color-Naming Scores

	Introvert Mean	Extravert Mean	Experimental Coefficient
First Trial	3.6408	2.2643	1.6079
Second Trial	2.9612	2.3877	1.2402
Both Trials	8.1553	4.8248	1.6903

TABLE LII

The Frequency Distribution of Scores on Color-Naming—Total Time

Scale	Introverts	Extraverts	Combined
Time in Tenths of Seconds:			
90– 96	2	..	2
97–103	2	..	2
104–110	2	4	6
111–117	5	8	13
118–124	4	8	12
125–131	8	10	18
132–138	2	8	10
139–145	13	14	27
146–152	15	5	20
153–159	9	12	21
160–166	11	9	20
167–173	8	9	17
174–180	1	2	3
181–187	3	4	7
188–194	1	2	3
195–201	7	1	8
202–208	3	1	4
209–215	4	3	7
216–222	..	..	..
223–229	..	..	..
230–236	..	..	..
237–243	1	2	3
244–250	..	..	..
251–257	..	..	..
258–264	1	1	2
404–411	1	..	1

d. The overlap of the distributions when scores on both trials are combined into one score is 53.85 per cent with a standard error of .3338, and 454 chances in 1,000 that the overlap is one of pure chance. The overlap consistently decreases after the first trial, until it approaches one of pure chance.

First Trial overlap=78.35%
Second Trial overlap=58.49%
Combined Scores overlap=53.85%
Pure Chance overlap=50%

PLATE XXIV

A Comparison of the Scores Made by a Group of 103 Introverts on Color-Naming, Total Time, with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and Variability

	Introverts	*Extraverts*
median	151.333	144.75
mean	157.403	149.248
σ distrib.	39.732	28.620
σ mean	2.915	2.820

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 8.1553
σ difference	= 4.8248
Experimental Coefficient	= 1.6903
Q	= 46 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 53.85%
σ overlap	= .3338
Experimental Coefficient	= .1153
Q	= 454 in 1,000

On examination of Table LIII, we learn that the correlations follow to all intents and purposes the same trends that were found in the study of the relationships of the first trial, and need, for that reason, not to be emphasized in further detail. It is of interest to note that throughout the three studies the correlations between criterion and test score are positive; between age and test, negative and significant; and between intelligence and test, negative and significant.

TABLE LIII

THE CORRELATIONS BETWEEN SCORES ON COLOR-NAMING, TOTAL TIME, AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	INTROVERT GROUP	EXTRAVERT GROUP	COMBINED GROUP
r_{12}	.019 ± .066	.166 ± .065	* .145 ± .058
r_{23}	− .276 ± .061	− .372 ± .057	− .303 ± .043
r_{24}	− .267 ± .061	− .335 ± .057	− .321 ± .043

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

From the foregoing discussion, it appears that giving a second trial does not bring out any added differences in behavior between the introverts and extraverts, except to show that some learning has taken place, which slightly increases the correlation with intelligence in the second trial.

There is a slight but constant tendency for the extravert group to show a positive correlation with time score on both the first and second trials. Oddly, the introvert group remains consistently near zero correlation.

4. QUALITATIVE DIFFERENCES

Table LIV attempts to show in part some of the qualitative differences in meeting the conditions of the color-naming test [3] which were shown by the two contrasted groups. The outstanding fact of the performance is the fact that the interference phenomenon mentioned by Woodworth and Wells tended to occur about equally often in both groups. There was no clear difference as to the point at which it occurred, though the experimenters were agreed that the difficulty tended to disappear sooner in the case of introverts than it did in the case of the extraverts.

[3] As indicated before, the mechanical difficulties of recording all the different items which were thought of in connection with this test proved so baffling that the qualitative difference record is incomplete. Such data as were secured, however, do not point to any convincing qualitative differences in response to the color-naming test.

TABLE LIV

QUALITATIVE DIFFERENCES IN RESPONSE TO THE COLOR-NAMING TEST AS BETWEEN INTROVERTS AND EXTRAVERTS

	INTROVERTS	EXTRAVERTS
1. SPEED AND INTERFERENCE		
Rapid speed, no interference	8	13
Rapid speed, with interference	6	2
Rapid speed, total score = 90″–120″		
Medium speed, no interference	22	24
Medium speed, with interference	46	49
Medium speed, total score = 121″–180″		
Slow speed, no interference	5	0
Slow speed, with interference	16	15
Slow speed, total score = 181″–411″		
2. NATURE OF INTERFERENCE		
Blocking (speech failure)	28	25
Transposition (mistakes)	23	26
Omissions	4	2
Emotional display	13	18
Perseveration	4	0
3. SUBJECT'S EXPLANATION		
"Forget the names"	2	2
"Colors blur. Can't see"	5	5
"Go too fast. Look ahead"	13	7
"Get mixed up"	11	10
"Tongue gets twisted"	9	11
"Recognize but can't say"	29	25
No explanation	24	4

CHAPTER XIII

THE TREND QUESTIONNAIRE (WOODWORTH) AND INTROVERSION-EXTRAVERSION

General Considerations

The "personal data" lists developed by R.S. Woodworth during his study of unstable recruits in connection with the draft of 1918 have been used either in principle or in actual content by a number of workers. Among the earliest available studies of efforts to use the scale on children of school age is that of Miss Edith M. Everett [70] in connection with a study of emotional stability of school children. About the same time, Buford Johnson [71] constructed an abbreviated list of sixty items to be used with children up to age twelve. The list was tried on a nutrition group in connection with a study made by the Public Education Association of New York. The same list was also tried on a selected group in Baltimore. Johnson concluded that ten unfavorable responses justify the suspicion of instability; fifteen, a tendency toward abnormality; and that twenty-five warrant grave suspicions of abnormal condition. Johnson found a positive correlation between unfavorable responses and age.

Miss Ellen Matthews [72] reported a study of emotional stability in children in 1923. She employed two series of lists containing sixty and forty items each, and reached the conclusion that "neurotic [children] respond, as a whole, with more unfavorable answers than do those who are not so selected." She found much overlapping, and shows that the self-correlation of the scores of a group of boys is .667. The Matthews-Woodworth questionnaires were used by Slawson [73] in a study of the psycho-neurotic trends of 879 delinquent boys in three New York institutions. He concludes that the test has definite diagnostic value, and finds that the correlation between scores and age is negative.

Dagny Sunne [74] reports a study from Tulane University on personality tests for 751 negro and white adolescents from Grade 7 to college. The Pressey, Downey, and Woodworth tests were employed, and significant findings are reported.

Using the method of the graphic scale suggested by Freyd [75] and recommended by Symonds [76], Laird [16] constructed a series of questionnaires or "spotting tests" by means of which it is proposed to discover psychasthenoid, schizoid, hysteroid, and neurasthenoid tendencies. Schedule C1 is intended to be diagnostic for introversion-extraversion. Hoitsma [18] reports a reliability of .674 for two trials of Schedule C1. The content of the Laird spotting tests follows in the main the principle laid down by Woodworth, but elaborates the form of response required of the subject, as indicated above.

The basic principle of the questionnaire appears to have possibilities. One hundred fifty items which were mentioned in the literature as being characteristic traits of introverts or schizoids,[1] and extraverts or cycloids,[2] were assembled and used in two unpublished studies during the years 1922-1924. It became apparent from these investigations that, of the "traits" described in treatises bearing on psychoneurotic or psychopathic types, some were of accidental, possibly temporary type only, resulting from a chance individual conditioning of response, while others appeared to be fundamental, coloring the whole fabric of the personality. Accordingly, by a process of elimination, all those items were dropped which might be thought of as belonging to the first category, and thirty-one items which seemed to belong more or less clearly to the permanent fundamental set of the introvert individual were retained, and used as a trend questionnaire. The list of items and the directions used are given on the following page.

A careful study of these items will show that they tend to fall into three groups. The first ten relate more particularly to health and habit trends; the next eleven relate to social adjustment; the last ten relate to psychasthenic phobias and manias. The list might well be expanded by adding items to which the extraverts would react as characteristically as the introverts do to this one. The studies above referred to warrant further investigation.

[1] Schizoids, individuals with exaggerated introvert tendencies.

[2] Cycloids, persons with exaggerated extravert tendencies.

Directions and Items for Trend Questionnaire

Answer the questions below by making a ring around YES if you mean to say yes, and a ring around NO if you want to say no. Answer the questions to the best of your ability according to the facts as you know them. Be sure to answer every one of the questions.

1. Do you generally have good health?	YES	NO
2. Are you tired a good deal of the time?	YES	NO
3. Are you inclined to worry about your health?	YES	NO
4. Do you wake up in the morning full of pep and energy?	YES	NO
5. Do you generally sleep soundly at night?	YES	NO
6. Are you troubled often with bad dreams or nightmares?	YES	NO
7. Do you sometimes wake up at night badly frightened for no special reason?	YES	NO
8. Do you find it easy to laugh heartily about things?	YES	NO
9. Are you easily discouraged?	YES	NO
10. Does failure of any kind greatly upset you?	YES	NO
11. Are your feelings easily hurt?	YES	NO
12. Do suggestions from other people irritate you?	YES	NO
13. Does it trouble you to start a conversation with a stranger?	YES	NO
14. Would you rather work and play by yourself alone, if you could have your way?	YES	NO
15. Do you like to mix and talk with people?	YES	NO
16. Do you like to attend parties and dances?	YES	NO
17. Does it bother you to have people watch you at work or play?	YES	NO
18. Do you have trouble in being and doing like other people when you are with them?	YES	NO
19. Do you feel uncomfortable in the presence of strangers?	YES	NO
20. Are you bothered with a feeling that you cannot do all that people are expecting of you?	YES	NO
21. Do you find day-dreaming more satisfying than doing real things?	YES	NO
22. Are you afraid of noises at night, or when you are alone?	YES	NO
23. Are you afraid of water, or fire, or thunderstorms? Please underline which you are afraid of.	YES	NO
24. Are you afraid of the dark or of dark places? Underline.	YES	NO
25. Does it disturb you to have to change from old ways to new ways of doing things?	YES	NO
26. Does it worry you to be in a tunnel, or in a narrow place, or a small room with the door closed? Please underline which one.	YES	NO
27. Are you afraid of falling when you are up on high places?	YES	NO
28. Do you sometimes find it hard to breathe, as if you were suffocating?	YES	NO
29. Are you uneasy when you are in a crowd?	YES	NO
30. Are you uneasy about, or afraid of cats, dogs, or horses? Which?	YES	NO
31. Do you sometimes have a blind impulse to set fire to something?	YES	NO

TABLE LV

TOTAL NUMBER OF INTROVERTS AND EXTRAVERTS RESPONDING SIGNIFICANTLY TO EACH ONE OF THE ITEMS IN THE ABBREVIATED WOODWORTH LIST, AND THE RATIO OF THE POSITIVE RESPONSES OF INTROVERTS AND EXTRAVERTS TO EACH ITEM

NUMBER	ITEMS	INTRO-VERT	EXTRA-VERT	RATIO
1.	Do you generally have good health?	8	4	2.000
2.	Are you tired a good deal of the time?	17	9	1.889
3.	Are you inclined to worry about your health?	10	5	2.000
4.	Do you wake up in the morning full of pep and energy?	36	18	2.000
5.	Do you generally sleep soundly at night?	12	6	2.000
6.	Are you troubled often with bad dreams or nightmares?	11	7	1.571
7.	Do you sometimes wake up at night badly frightened for no special reason?	19	14	1.357
8.	Do you find it easy to laugh heartily about things?	33	19	1.737
9.	Are you easily discouraged?	31	19	1.632
10.	Does failure of any kind greatly upset you?	50	39	1.282
11.	Are your feelings easily hurt?	43	33	1.303
12.	Do suggestions from other people irritate you?	22	17	1.294
13.	Does it trouble you to start a conversation with strangers?	61	33	1.848
14.	Would you rather work and play by yourself alone, if you could have your way?	20	11	1.818
15.	Do you like to mix and talk with people?	31	10	3.100
16.	Do you like to attend parties and dances?	43	20	2.150
17.	Does it bother you to have people watch you at work or play?	29	15	1.933
18.	Do you have trouble in being and doing like other people when you are with them?	29	15	1.933
19.	Do you feel uncomfortable in the presence of strangers?	56	36	1.555
20.	Are you bothered with a feeling that you cannot do all that people are expecting of you?	56	43	1.302
21.	Do you find day-dreaming more satisfying than doing real things?	19	15	1.267
22.	Are you afraid of noises at night, or when you are alone?	34	24	1.417
23.	Are you afraid of water, or fire, or thunderstorms	59	43	1.372
24.	Are you afraid of the dark, or of dark places?	37	23	1.609

TABLE LV (*Continued*)

Number	Items	Introvert	Extravert	Ratio
25.	Does it disturb you to have to change from old ways to new ways of doing things?	45	25	1.800
26.	Does it worry you to be in a tunnel, or in a narrow place, or a small room with the door closed?	39	24	1.625
27.	Are you afraid of falling when you are up on high places?	61	47	1.298
28.	Do you sometimes find it hard to breathe, as if you were suffocating?	25	12	2.083
29.	Are you uneasy when you are in a crowd?	21	13	1.615
30.	Are you uneasy about, or afraid of cats, dogs, or horses?	19	13	1.462
31.	Do you sometimes have a blind impulse to set fire to something?	11	52	2.200
	Total	990	634	1.561

From Table LV may be seen the response tendencies of the introverts and extraverts, respectively, to each one of the thirty-one items.

If the ratio of the frequency of the introvert significant responses to the frequency of the extravert significant responses could be thought of as the indicator value of each item, it might be possible to evaluate provisionally the diagnostic significance of each item of the list, whenever that particular item was significantly responded to.

The introvert adolescent would seem to be nearly twice as conscious of neurasthenoid tendencies as the extravert is. He is more conscious of inadequacy, of physical depletion, of inner maladjustment. He shrinks more from human contacts and finds the presence of others more or less provocative of distress and malaise. He is more the creature of phantasy and develops an excessive number of phobias and manias. The admissions summarized in Table LV depict the introvert almost in the same colors as do the judgments of the teachers who furnished the criterion ratings.

Trend Questionnaire Scores

A score on the Trend Questionnaire is the sum of the responses which are thought of as significant of a pathological trend.

Table LVI presents the distributions of scores on the Trend Questionnaire for each of the two contrasted groups, and for the two groups combined into one. Plate XXV and Table LVII show the results of a statistical analysis of these scores.

A critical examination of Table LVII and of Plate XXV shows the following facts:

a. The distribution of the scores of introverts and extraverts is approximately normal.

b. The variability of the trend scores of the introvert group is 1.4703 times that of the extravert group. The total range of the scores of the introverts is slightly greater than that of the scores of the extraverts. The effective range of the first group, however, is seven class intervals larger than that of the second.

TABLE LVI

THE FREQUENCY DISTRIBUTION OF SCORES ON TREND QUESTIONNAIRE

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
Number of Items Marked Significantly:			
0	..	3	3
1	..	7	7
2	5	5	10
3	2	10	12
4	4	15	19
5	9	6	15
6	4	11	15
7	13	14	27
8	10	9	19
9	6	5	11
10	7	4	11
11	12	9	21
12	7	1	8
13	4	1	5
14	7	..	7
15	2	..	2
16	5	1	6
17	..	1	1
18	1	1	2
19	2	..	2
20	2	..	2
21	..	..	..
22	1	..	1

PLATE XXV

A Comparison of the Trend Questionnaire Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	8.750	5.500
MEAN	9.112	5.646
σ distrib.	4.392	3.621
σ mean	.4327	.3568

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 3.466
σ difference	= .5446
Experimental Coefficient	= 6.3639
Q	= Practically 0 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 78.64%
σ overlap	= .0538
Experimental Coefficient	= 5.3234
Q	= .003 in 1,000

c. The mean score of the introvert group on the trend questionnaire is larger than the mean score of the extraverts. The difference between the two is 3.4460, and the standard error of the difference is .5446. The experimental coefficient is 6.3639. There is less than .003 of 1 chance in 1,000 that the difference in scores does not represent a real difference between the groups.

d. The overlap is 78.64 per cent., with a standard error of .0538. The experimental coefficient is 5.3234, and the chances about .003 of 1 chance in 1,000 that the overlap is not significant.

From Table LVIII, we observe the following relationships:

a. The correlation between criterion and trend score is contradictory. The introvert group shows a positive correlation, while that of the extravert group is negative. The correlations for the separate groups are not large, but they indicate the existence of a consistent tendency for the trend scores of the introverts to

TABLE LVII

THE CORRELATIONS BETWEEN SCORES ON THE TREND QUESTIONNAIRE AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1 = Criterion
Variable 2 = Test Score
Variable 3 = Age
Variable 4 = Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	.195 ± .064	− .124 ± .065	* .496 ± .047
r_{23}	− .074 ± .066	− .044 ± .066	− .04 ± .046
r_{24}	.100 ± .065	.068 ± .066	− .041 ± .046

* Coefficients preceded by an asterisk are Biserial *r* coefficients.

rise as criterion scores rise. The combined group coefficient is significant and positive.

b. The correlations with age are small, and tend to be negative in the separate contrasted groups. Age plays little or no part in determining score on the trend questionnaire.

c. The correlations of intelligence with trend score are small and positive, except in the combined group, where they are negative. Such correlation as exists is small, though slightly larger in the case of the introvert group than in the case of the extravert group. The difference, however, is not significant. Intelligence shows only a slight tendency toward being a correlate of trend score.

The series of trend questions used here appears to be to some extent descriptive of the introvert individual. It will be recalled that the items involve neurasthenoid, schizoid, and psychasthenoid trends, which are precisely the traits which would be expected in introvert subjects. Intelligence appears to cloud the relationship between trend scores and criterion only to a slight degree.

Age, within the limits of this study, has no bearing on trend score. Such traits as are here discussed appear to occur without reference to the ages covered by the two groups examined.

CHAPTER XIV

CONDITIONED AFFECT (TRAVIS) AND INTROVERSION-EXTRAVERSION

General Considerations

A study of the characteristic responses of introverts and extraverts indicates that there is a definite tendency for fixed affect trends to color the pattern of daily life. In the case of the introvert, "avertive trend" is reported as present and characterizing the total attitude of the subject, while in the case of the extravert a corresponding prorrective tendency is said to be equally characteristic. One type timidly shrinks from social contact; the other eagerly and, for the most part, joyously reaches out for social stimulus. It may be precisely this temperamental difference which makes the introvert appear cold, apathetic, and unapproachable, while the extravert appears enthusiastic, affable, and cordial. Downey [77] discusses substantially these facts, when she suggests as one of the factors of "will-temperament" the "tendency in some persons, of nervous energy to discharge immediately into the motor areas and innervate the muscles and glands, and in others, on the contrary, to find a way out by a round-about path of discharge."

It would seem as though it should be possible to approach the question of the type of responses which an individual habitually uses by securing a sampling of the emotional reactions which tend to accompany type situations. Pressey's X-0 test for investigating the emotions when used by Chambers [78] in measuring the emotional maturity of children, enabled him to select seventeen out of twenty problem cases. Preliminary experiment led to the conclusion, however, that the Pressey test implied a vocabulary much larger than school children included in this study possess.

Conklin [21] reports a study based on a list of situations presented in the form of an infinitive phrase, to which his subjects

were to react in terms of a pleasure-displeasure judgment. Nine steps varying from intense pleasure to intense displeasure are recognized. Conklin uses his list to differentiate normal introvert and extravert individuals. He finds a self-correlation of .92, or better, for the test.

The procedure, reported earlier by Travis [30], resembled Conklin's plan and appeared to have possibilities. Assuming that fundamental maladjustments to human situations are involved in all introversion, and assuming further that some of the trends reported as characteristic of dementia praecox [79, 80] are at least to a degree incipient in introversion, and assuming further that verbal situations such as Travis presents actually provoke emotional responses akin to those which would be provoked by reality, then the Travis program of emotion sampling should be useful in separating introvert and extravert cases.

Accordingly, twenty-four pairs of verbal situations were selected from Travis' list. One pair was repeated as a check on the reliability of the responses. These verbal situations and the directions used in connection with them are reproduced herewith.[1] The pairs of situations were printed in the form in which they appear here and a copy was given to each subject with the request to read the list and "do what it tells you to do."

DIRECTIONS AND ITEMS USED IN SAMPLING CONDITIONED AFFECT

Below are two lists of things to do or to have happen to you. Read each list carefully.

As you read, make a *plus mark* (+) in the parentheses in front of each thing that you would like to do or to experience, and a *minus mark* (—) in the parentheses in front of each thing that you would dislike to do or to experience.

Put a ring around the plus or minus mark if you especially like or dislike a particular thing.

Mark every statement either with a plus or a minus mark.

LIST A	LIST B
( ) Do the things you dream about.	( ) Have some one stare at you.
( ) Receive a box of fine presents.	( ) Sell tickets for an entertainment.
( ) Take advice from your friends.	( ) Have your mother caress you.
( ) Tell your sorrows to a sympathetic listener.	( ) Go on a picnic with your class.
	( ) Be independent of others.
( ) Disregard the advice of others.	

[1] The writer gratefully acknowledges permission granted by Dr. Travis to use the scale as discussed for purposes of research.

List A (*Continued*)	List B (*Continued*)
( ) See somebody get a beating.	( ) Read the funny paper.
( ) Look on the bright side of things.	( ) Show off your good points before people.
( ) Take life more seriously.	
( ) Nurse a wounded person.	( ) Work and play by yourself.
( ) Regard the feelings of others.	( ) Make friends very easily.
	( ) Obtain the approval of a girl friend.
( ) Take responsibility.	( ) Get out of taking part in a public performance.
( ) Be held down by others.	
( ) Be with a group of boys with no girls present.	( ) Show people that you are master.
	( ) Be with a group of girls with no boys present.
( ) Be recognized as a leader.	
( ) Keep quiet in company.	( ) Shun people that work against you.
	( ) Be first to try a new stunt.
( ) Obtain the approval of a boy friend.	( ) Help others when they need it.
	( ) Undergo an operation.
( ) Just chum with anyone.	( ) See people in trouble.
( ) Keep your troubles to yourself.	( ) Show others that you are happy.
( ) Have your good traits recognized.	( ) Kill a mosquito.
( ) Tell a funny joke.	
( ) Be independent of others.	( ) Disregard the advice of others.
( ) Attend a dance.	( ) Have others know how unfortunate you are.
( ) Work and play with your mother.	
( ) Ask an employer for a job.	( ) Act promptly on what people tell you.
( ) Have a stranger touch you.	
	( ) Look out for yourself first.
	( ) Tell your plans to other people.

The paired items were arranged in two series, and the order of the items in the second series was reversed, that is, the first item of List A pairs with the last item of List B.

Conditioned Emotion Scores

Various combinations of scores were tried and correlations computed, with the result that it was found that the best correlations were found when the sum of the positive scores in List A was added to the sum of the negative scores in List B. Apparently, there is a tendency on the part of both the extraverts and the introverts to react with a larger number of pleasure responses during the first half than during the second half. The tendency is more clearly marked in the case of the extraverts, as may be seen from Table LVIII.

TABLE LVIII

THE FREQUENCY OF THE VARIOUS TYPES OF RESPONSES TO THE CONDITIONED AFFECT SURVEY

	TYPE OF RESPONSE				
	(−)	−	+	(+)	NO RESPONSE
INTROVERTS					
List A	96	975	1,368	126	10
List B	104	1,262	1,109	93	7
EXTRAVERTS					
List A	108	867	1,413	179	8
List B	151	1,248	1,052	106	18

Table LVIII shows an interesting tendency of both groups to make a larger number of displeasure responses in connection with List B than they made with List A. There is nothing in the content of List B to explain this tendency.

How marked this tendency to change from pleasure responses to displeasure responses is, appears from the following ratios:

1. In the case of the introverts in the first list:

$$\frac{\text{Sum of } (-) \text{ responses}}{\text{Sum of } (+) \text{ responses}} = 96/126, \text{ or } .7619,$$

while in the second list the ratio is 104/93, or 1.1182.

2. In the case of the extraverts in the first list, the corresponding ratio is 108/179, or .6033, while in the second list the ratio is 151/106, or 1.4245.

For comparison, Table LIX presents these ratios in tabular form.

TABLE LIX

THE RATIO OF INTENSE PLEASURE RESPONSES TO INTENSE DISPLEASURE RESPONSES IN THE TWO LISTS OF THE CONDITIONED AFFECT SURVEY

	LIST A	LIST B
INTROVERTS	.7619	1.1182
EXTRAVERTS	.6033	1.4245

Table LIX clearly shows the tendency to have more marked pleasure responses in the first list, and decidedly more marked displeasure responses in the second list, especially in the case of the extraverts.

Table LVIII points also to a definite tendency of the extravert group to react with more energetic expressions of pleasure and displeasure than the introvert group. As a matter of fact, the following relationships appear:

1. The ratio of the sum of the (—) responses of the introverts to the sum of the (—) responses of the extraverts is .7721.

2. The ratio of the sum of the (+) responses of the introverts to the sum of the (+) responses of the extraverts is .7684.

3. The ratio of the sum of all the (—) and (+) responses of the introvert group to the sum of all the (—) and (+) responses of the extravert group is .7702.

It appears, therefore, that the introvert group has a consistent tendency to report about three-fourths as many intense affects as are reported by the extraverts.

The score for any subject used in the more intensive study which follows is a composite of the sum of all the uncircled plus responses made in the first list, plus twice the number of circled plus responses made in that same first list, plus the sum of all the uncircled minus responses made in the second list, plus twice the circled minus responses made in that same second list. This composition of scores was empirically arrived at after extensive sampling of other methods. The distribution of the total scores as used in this study follows in Table LX. Plate XXVI and Table LXI present the results of the statistical study of these scores.

An analysis of Table LX and of Plate XXVI and Table LXI reveals the following facts:

a. The distribution of the scores of both of the contrasted groups has a slight positive skew.

b. The variability of the two groups is substantially the same. The sigma of the extravert group is 1.044 times that of the introvert group. The range of the scores of the extraverts is seven steps on the scale greater than the range of the introverts.

c. The mean score of the extravert group is larger than that of the introverts. The difference between the mean scores is 2.6796,

TABLE LX

THE FREQUENCY DISTRIBUTION OF SCORES ON CONDITIONED AFFECT SURVEY

SCALE	INTROVERTS	EXTRAVERTS	COMBINED
20	..	..	..
21	..	..	..
22	3	1	4
23	1	..	1
24	5	1	6
25	5	5	10
26	5	3	8
27	7	5	12
28	12	6	18
29	13	14	27
30	10	9	19
31	8	3	11
32	10	11	21
33	10	8	18
34	2	13	15
35	4	2	6
36	2	4	6
37	1	3	4
38	4	1	5
39	..	4	4
40	..	2	2
41	..	2	2
42	..	1	1
43	..	3	3
44	..	1	1
45	..	1	1
58	1	..	1

and the standard error of this difference is .6542. The experimental coefficient of this difference is 4.2587, which implies that there is hardly 1 chance per 10,000 that the difference in central tendency between the two groups is not a real one.

d. The overlap of the two distributions is 39.95 per cent with a standard error of .0625. The experimental coefficient of the difference between the obtained and a purely chance overlap is 3.208. There are barely 7 chances in 10,000 that the overlap rests on the basis of a purely chance difference in the trends of the distributions compared. The difference in fundamental tendency seems to be a reliable one.

PLATE XXVI

A Comparison of the Conditioned Affect Survey Scores Made by a Group of 103 Introverts with the Scores Made by a Group of 103 Extraverts on the Same Test

I. The Measures of Central Tendency and of Variability

	Introverts	*Extraverts*
MEDIAN	29.50	31.315
MEAN	29.5097	32.1893
σ distrib.	4.6016	4.8376
σ mean	.4534	.4756

II. The Measure of Difference and Its Reliability

Difference between the Mean Scores	= 2.6796
σ difference	= .6542
Experimental Coefficient	= 4.2587
Q	= .1 in 1,000

III. The Measure of Overlapping and Its Reliability

Proportion of Scores of Introverts Which Equals or Exceeds the Median Score of the Extraverts	= 39.95%
σ overlap	= .0625
Experimental Coefficient	= 3.208
Q	= .7 in 1,000

Table LXI shows the following facts:

a. The correlations between the criterion and test scores are exceedingly small when the contrasted groups are considered separately. When the combined groups are considered there is a small but significant Biserial correlation of —.313. The introverts respond somewhat more sparingly with frank expressions of like and dislike than the extraverts—to be accurate, introverts show emotion about .77 as often as extraverts do.

b. The correlation of age with test score is variable as to quality, and small in quantity. The difference between the correlation of the two contrasted groups may be a pure chance difference.

c. The correlation of intelligence with test score is even smaller than that of age. Conklin [79] reports correlations of .37 with intelligence. Laird reports zero correlation with intelligence, which is in substantial agreement with the present findings.

TABLE LXI

THE CORRELATIONS BETWEEN SCORES ON CONDITIONED AFFECT SURVEY AND THE CRITERION RATINGS, AGE, AND INTELLIGENCE SCORES OF (1) A GROUP OF 103 INTROVERTS, (2) A GROUP OF 103 EXTRAVERTS, AND (3) THE TWO GROUPS COMBINED INTO ONE COMPOSITE GROUP

Variable 1=Criterion
Variable 2=Test Score
Variable 3=Age
Variable 4=Intelligence

	Introvert Group	Extravert Group	Combined Group
r_{12}	.008 ± .067	− .051 ± .066	*− .313 ± .057
r_{23}	− .103 ± .065	.078 ± .066	− .005 ± .047
r_{24}	.0495 ± .066	.009 ± .067	.017 ± .046

* Coefficients preceded by an asterisk are Biserial r coefficients.

It would appear from the facts presented above that there is a tendency for both introverts and extraverts to reverse their responses to this test after the first impact of the situation is over. On the whole, the extraverts react more freely and intensely than the introverts. Their total scores are higher in both halves of the test. In the first half, however, both the extraverts and the introverts react with more plus responses, while in the second half the reverse is true. Apparently, each group goes through a process of adjustment.

The above interpretations are based on the assumption that the pairs of situations selected actually tap similar trends in each subject. Travis, using the complete series of fifty pairs of items found a satisfactory correlation with the criterion, which in his study consisted of expert medical opinion with reference to the trends of hospital patients. The test is essentially a survey of affects which are assumed to be more or less permanently fixed to various life situations. It describes the introvert as somewhat less inclined to reveal his affects (if he has them) than the extravert is. Extending the number of situations would tend to produce a higher correlation, if the Spearman-Brown formula holds good.

A graded scale, such as that employed by Conklin, was considered out of the question with juvenile subjects who are not at all trained in introspection. If such a scale were feasible, it might

reveal even more clearly than appears in the study above the tendency of the extravert to express himself freely in intense responses, while the introvert either employs more cautious terms or has less intense emotions, quite apart from either age or intelligence.

The most significant weakness of the procedure lies in the fact that its results depend upon the accuracy and good will of the subject in reporting his emotional states. There is no objective record by which the response may be checked as to its factual reliability. It is useless to compute a coefficient of reliability, because the trend of the responses reverses itself, and it is not clear just where the reversal takes place.

CHAPTER XV

AN ANALYSIS OF THE RESULTS OF THE STUDY

From the ratings of the judges, we may conclude that at least in their opinion there are individuals whose behavior patterns correspond to the concepts of introvert and extravert. Psychiatry and the observations of abnormal psychology lead us to expect that such behavior types might be found within the limits of normal behavior.

I. The Difference Between the Responses of the Contrasted Groups

The question whether there be actual, constant, and reliable differences between the reactions of introverts and extraverts can now be answered in three ways: (1) by comparing the differences between the means of the performances just presented, (2) by studying the overlapping of the scores of the introverts with those of the extraverts, and (3) by considering in detail the coefficients of correlation and their reliability. For convenience of reference, these items are now presented separately.

1. the differences of mean scores

Consideration of the content of Table LXII brings out clearly the fact that

a. When intelligence is measured by the multimental scale, the scores of the introverts tend to be 4.5 T scores smaller than those of the extravert. This may reflect either an actual difference in intelligence or it may reflect a certain deliberate hesitation in reaching conclusions possibly akin to a decision-phobia, which we shall discuss later, and which has already been mentioned.

b. The mean introvert speed of response to the one-hundred-word association test is nearly a second longer than the mean speed of the extraverts. The difference holds constant throughout the test, whether conclusions are based on mean time, median

TABLE LXII

THE DIFFERENCES BETWEEN THE MEANS OF THE SCORES OF INTROVERTS AND EXTRAVERTS, THE STANDARD ERRORS OF THESE DIFFERENCES, THE EXPERIMENTAL COEFFICIENTS, AND THE CHANCES PER THOUSAND THAT THE OBSERVED DIFFERENCES ARE RELIABLE DIFFERENCES

SCORES	DIFF.	S. E. OF DIFF.	E. C.*	CHANCES PER 1,000
1. Multimental T Score	− 4.5437†	1.1384	3.9912	999.99
2. Mean Association Time	+ .9820	.1573	6.2550	999.99
3. Median Association Time	+ .5107	.0840	6.0787	999.99
4. 90 Percentile Association Time	+ 2.8681	.4812	5.9606	999.99
5. Response Failure	+ .9709	.4236	2.292	989.00
6. Reproduction Failure	− .6408	1.5377	.4167	661.5
7. Word Range	− 1.2816	1.0450	1.2264	898.98
8. Contrast Response	− 5.6796	1.1623	4.8866	999.99
9. Ink Blot Nouns	− 7.0485	1.5178	4.6438	999.99
10. Ink Blot Verbs	+ .4757	+ .3719	1.2789	899.5
11. Unspeeded Motor Output	− 9.1748	2.8259	3.2467	999.4
12. Speeded Motor Output	− 12.2346	3.489	3.5066	999.77
13. Total Motor Output	− 21.9417	6.0742	3.6123	999.84
14. Kinetic Reserve	+ 4.0777	6.2771	.6496	742.2
15. Multiple Choice	+ 21.5534	7.1447	3.0043	998.65
16. Weight Selection	+ 5.1456	8.6092	.5977	725.
17. Weight Suggestibility	− .6990	.2794	2.5017	993.8
18. Motivated Choice	+ 3.4078	1.8612	1.8309	966.4
19. Picture Suggestibility	− .4272	.6089	.7019	758.
20. Color-Naming, 1st trial	+ 3.6408	2.2643	1.6079	946.
21. Color-Naming, 2nd trial	+ 2.9612	2.3877	1.2402	892.5
22. Color-Naming Total	+ 8.1553	4.8248	1.6903	954.5
23. Trend Questionnaire	+ 3.4660	.5446	6.3639	999.99
24. Conditioned Affect	− 2.6796	.7252	3.695	999.89

* E. C., an abbreviation for Experimental Coefficient.

† Differences are noted as negative if the mean score of the introverts is smaller than that of the extraverts. They are noted as positive when the relation is reversed.

time, or 90 percentile time. The difference is not due merely to an accumulation of long times, but is found at all points of the test, and seems to point again to the deliberation above mentioned. Jung and others call attention to the fact that the subjective type tends to make a richer, more critically evaluated response than the objective type. The delay may well be due to this evaluation habit rather than to deficient intelligence.

c. Response failure in the association test is not convincingly a characteristic of introversion. There is a marked tendency in this direction to be sure, but in about one case in one hundred the situation is reversed.

d. Reproduction failure, often mentioned as a diagnostic sign of some value, is certainly not reliably indicative of a trend toward either introversion or extraversion.

e. A tendency toward perseveration and stereotypy as revealed by the number of different words used in responding is not conclusively a diagnostic trait of either the introvert or the extravert group.

f. A tendency to react to the association test by means of contrast responses is, as was said earlier, very definitely indicative of extraversion. Short reaction times and superficial responses that involve well-worn association bonds characterize the extraverts, while long reaction times, with a profounder, less predictable, often affect-tinged response are the habit of the introvert.

g. The introvert is distinctly less productive when confronted with the ink blot stimulus than the extravert. This is not true of verbs, especially verbs which express action or relationship in which the introverts excel slightly but not convincingly. In the matter of nouns, adjectives, and qualifying adverbs, indicative of a vivid rich stream of imagery which finds ready access to the motor mechanisms of oral speech, the extravert excels. This does not necessarily mean that the introvert does not have images, but there is reason to believe that he tends to a type of imagery less colorful and fluid, more definitely in terms of a deeper response of the self than is the case with the extravert. Possibly McDougall's doctrine of a difference of psychic coherence is here applicable.

h. The introvert moves more slowly than does the extravert, whether he labors under pressure or at his own natural rate. The difference in the rate of movement tends to be slightly more marked when the contrasted individuals work under pressure. Either the tempo is slower because of some subjective inhibition, or the introvert has a trend toward covert rather than free overt response, or he has a smaller amount of energy available per unit of time. There is excellent authority for each of these opinions. Whatever the reason is, the introvert tends to make

a smaller number of marks per unit of time, whether speeded or unspeeded, than the extravert makes.

i. There is no significant difference in the ratio of speeded to unspeeded motor output. Both groups speed up in nearly the same proportion. The introvert group tends slightly to lag more markedly under pressure than when not under pressure. The lag alone, however, does not constitute a convincing difference between the groups. If the kinetic ratio here employed is similar at all to Downey's "Freedom from Load" then "Freedom from Load" or its absence is not a distinguishing characteristic of either extraverts or introverts.

j. The introvert tendency to respond deliberately reappears again in a convincing degree in the task of arranging ten stereograms in the order of preference. That this deliberation of response is not a matter of intelligence is indicated as will be shown later in greater detail, by the fact that while performance on this test is correlated with the criterion +.257, it is correlated with the intelligence score —.085. The difference in rate of speed of picture choice would seem to be due at least in part to something other than a difference of intelligence. The tendency to make response via more complicated cortical pathways, with consequent delay and selective inhibitions may be here involved.

k. Resistance to suggestion, whether estimated by means of time required to determine the difference in the weight of boxes which were really equal, or by means of the assurance and quality of the response, or by means of the degree of readiness to define non-existent items in a picture, does not constitute a distinguishing earmark. Introverts are as ready to find the non-existent difference in box weights as are the extraverts, save that they are slightly slower. They are a trifle more inclined to be critically skeptical but none the less the differences between the mean scores are so slight as to be inconclusive. Travis [12] and McDougall [5] both think that extraverts are more suggestible than introverts. The results of the procedures employed in this study only faintly support the claim. It would be possible on the basis of our evidence to conclude either that the uncertainty inherent in the test retards the extravert response more than it retards the introvert response, or that it accelerates the introvert response. The former is the more likely, though the data at hand do not permit of a final conclusion. If the unusual nature of the

situation checks the extravert tendency to ready response more than it affects the introvert, the effect may well be to obliterate the difference in fundamental response tendencies, and to make both introvert and extravert times approximately equal.

l. The introduction of the factor of a personal gain motive apparently affects the mean introvert response to a slightly greater degree than does an unmotivated response. The difference between the mean times of the two groups, however, is not sufficiently great to constitute a significant difference. Just as in the case of the choice of equal weights, so here it is possible that the presence of the complicating personal factor slows the extravert to some degree, while it leaves the introvert relatively undisturbed, with the result that the reaction time difference tends to become smaller and less differential.

m. Naming colors does not provoke a differential response when the response is measured in terms of time. Qualitatively, however, as indicated earlier in the study, there are fairly significant differences. It is interesting to note that the time difference is greater when the sum of the scores of the two trials is considered. It raises the question whether more trials might not finally prove differential, after the novelty of the situation has disappeared, and the more rapid tempo of the extravert reasserts itself.

n. The introvert is undoubtedly more ready to make admissions indicative of neurasthenoid, autistic, and psychasthenoid trends than the extravert. Whether these trends are actually more frequent in the introvert, or whether his tendency to subjective analysis makes him more keenly aware of their presence is not indicated by the facts at hand. The overlapping is considerable, but in spite of the overlap there is practical certainty that there is a real difference between the contrasted groups in the way in which they respond to the test questions.

o. There is a real difference in the amount and quality of emotional output, if the indirect index employed in the last test may be accepted at its face value. The introvert seems to have a smaller number of situations which move him deeply, and he tends apparently to be somewhat more consistent in his affect life, i.e., the alternations between marked positive affect and marked negative affect are not so great as they are in the case of the extravert group. While the statement as here made is

based on the data of the test, and may be challenged as not founded on objective behavior other than a plus or minus mark made by the persons under examination, the facts as stated correspond fairly with the observations of daily experience, in which the introvert is found to be "cold, unemotional and unapproachable," while the extravert presents the opposite trends. The deficiency of emotional output noted in connection with the responses of the introvert group has been repeatedly noted as one of the earmarks of the schizophrenic group toward which the introverts are thought to incline.

Summary

The introvert, therefore, appears to be, in the presence of simple familiar uncomplicated situations, (*a*) slower in verbal response, (*b*) less freely productive of words, ideas, and movements, (*c*) slightly more tenacious in holding to the evidence of his own experience, (*d*) less given to superficial automatized responses, (*e*) more inclined to morbid anxieties, autistic trends, and psychasthenic obsessions and phobias, and (*f*) less inclined to admit the presence of a rich emotional life than is the contrasted extravert.

2. THE OVERLAPPING OF SCORES

In considering the facts of Table LXIII, it must be borne in mind that by basing the calculations on the median the more delicate differences between the two distributions are obscured if not entirely obliterated, because the overlapping takes into account only the number of cases which equal or exceed the median, and ignores the significant factor of how much they exceed. Kelley [31] suggests that "slightly more definite results may be obtained by finding the differences between means instead of the percentage of overlapping." This has already been done in Table LXII and Table LXIII is included here only for the purpose of comparison.

3. THE COEFFICIENTS OF CORRELATION

The question of the significance of test scores in describing characteristic differences of traits is approached in Table LXIV from the angle of the correlations existing between the criterion and test scores for the two contrasted groups separately and

TABLE LXIII

THE PER CENT OF THE SCORES OF INTROVERTS WHICH EQUAL OR EXCEED THE CORRESPONDING MEDIAN SCORE OF THE EXTRAVERTS, THE STANDARD ERROR OF THE OVERLAP, THE EXPERIMENTAL COEFFICIENT, AND THE CHANCES PER THOUSAND THAT THE OVERLAP IS RELIABLE

SCORES	OVERLAP	S. D. OF OVERLAP	E.C.*	CHANCES PER 1,000
1. Multimental T Score	34.1424	.1552	1.2019	847.
2. Mean Association Time	87.0931	.0332	11.1717	999.99
3. Median Association Time	82.41	.0374	8.6658	999.99
4. 90 Percentile Time	76.9846	.2436	6.1881	999.99
5. Response Failure	66.7555	.0678	2.4720	993.
6. Reproduction Failure	41.8123	.1281	.6393	739.
7. Word Range	45.6371	.1025	.4254	665.
8. Contrast Response	26.428	.1024	2.3017	893.
9. Ink Blot Nouns	27.9951	.1204	1.8281	966.
10. Ink Blot Verbs	59.4353	1.3351	.0707	528.
11. Unspeeded Motor Output	35.6609	.1772	.8092	791.
12. Speeded Motor Output	29.5687	.2975	.6837	753.
13. Total Motor Output	28.0582	.5169	.4245	664.
14. Kinetic Reserve	50.00	.4558	.000	500.
15. Multiple Choice	67.4272	.4378	.3981	655.
16. Weight Selection	51.699	.5241	.0032	501.
17. Weight Suggestibility	32.0846	.0548	3.2701	999.99
18. Motivated Choice	63.1068	.1487	.8816	811.
19. Picture Suggestibility	42.3079	.0640	1.2016	885.
20. Color-Naming, 1st Trial	78.3495	.2315	1.2246	890.
21. Color-Naming, 2nd Trial	58.4927	.2229	.3809	352.
22. Color-Naming Total	53.8489	.3338	.1153	546.
23. Trend Questionnaire	78.6408	.0538	5.3234	999.99
24. Conditioned Affect	29.95	.0625	3.208	999.

* E.C. is used as an abbreviation or the Experimental Coefficient.

when they have been combined into one single group. For the separate contrasted groups, the Pearson Product Moments formula was used. For the combined group, the Biserial *r* was calculated. It was thought that the latter might be somewhat more significant: first, because it is not so directly affected by minor differences of opinion among the rating judges, and, secondly, because it rests fundamentally on the concept of a dichotomy imposed upon a normal frequency distribution. With refer-

ence to the dichotomous division of the two groups, all the judges agreed, no matter how much they might disagree as to the actual amount of extraversion or introversion a given individual might

TABLE LXIV

THE PEARSON CORRELATIONS BETWEEN CRITERION AND TEST SCORES FOR THE INTROVERTS AND EXTRAVERTS SEPARATELY, AND ALSO THE BISERIAL *r* FOR EACH TEST, WHEN THE TWO GROUPS ARE COMBINED INTO ONE GROUP

CRITERION AND	INTROVERTS	EXTRAVERTS	BISERIAL *r*
1. Age	− .013	.125	− .031
2. Multimental T Score	− .023	.038	− .339
3. Mean Association Time	.150	.121	.6196
4. Median Association Time	082	.157	.487
5. 90 Percentile Association Time	.133	.047	.494
6. Response Failure	− .008	.004	.198
7. Reproduction Failure	− .016	.046	− .037
8. Word Range	.067	.004	.107
9. Contrast Responses	− .038	.006	− .406
10. Ink Blot Nouns	− .166	− .112	− .386
11. Ink Blot Verbs	− .156	.007	.111
12. Unspeeded Motor Output	− .052	.050	− .250
13. Speeded Motor Output	− .178	− .108	− .328
14. Total Motor Output	− .111	− .041	− .309
15. Kinetic Reserve	.003	− .145	.054
16. Multiple Choice	.097	.084	.257
17. Weight Selection	.302	− .018	.054
18. Weight Suggestibility	− .121	.006	− .216
19. Motivated Choice Time	− .133	− .015	.159
20. Picture Suggestibility	− .010	.075	− .061
21. Color-Naming, 1st trial	.014	.154	.148
22. Color-Naming, 2nd trial	.056	.110	.108
23. Color-Naming Total	.019	.166	.145
24. Trend Questionnaire	.195	− .124	.496
25. Conditioned Affect	.008	− .051	− .313

present. Inspection of the biserial coefficients indicates that variables 2, 3, 9, 10, 12, 13, 16, 24, and 25 present correlations which, though low, may none the less be considered as significant. Comparison of Table LXIV with Table LXII shows that these are precisely the variables with the largest and most reliable

differences between the mean scores of the contrasted groups. Table LXIII shows that the trend remains in general the same when the overlap of scores is considered, though with some marked changes for the reasons stated earlier. Account is taken in the list of variables given above of only one of the three variables which refer to the time of response to the stimulus words in the Association Test. Variables 3 and 4 are, of course, also significant in Tables LXII and LXIV as well as Table LXIII.

There are apparently interesting differences between the criterion-test-score correlations of the two contrasted groups taken separately. Are these differences at all significant? Table LXV undertakes to answer the question. With the exception of variables 16 and 23 the inter-group differences in the correlations existing between criterion and test score cannot be considered significant. Even in these two variables the difference is not finally convincing, since about once in one hundred times the difference would tend to disappear.

Variable 10 shows an interesting trend in contrast with 9. While there are indications of a possible tendency toward a definite difference of approach to the ink blot test when verbs are considered, this difference in attitude does not appear when nouns and modifiers are studied. The difference is perhaps a significant one, and is connected possibly with an essential difference in behavior trend in the presence of the ink blot situation.

Variables 20 and 21 show an interesting change in attitude as between the first and second trials of the color-naming test. The introvert tends slightly to increase his correlation in the second trial while the extravert decreases it. A similar difference in *Einstellung* was noted earlier as between the first and second halves of variable 24. It would seem as though any extended test program looking toward the diagnosis of introversion-extraversion might well guard against the tendency of initial differences to disappear as the introvert gains confidence and the extravert loses the sense of novelty. One apparently tends to speed up, the other to slow down, with the result that original differences in behavior tend to become obscured and to disappear.

II. The Influence of Age

Chronological age might be expected to affect the degree of introversion-extraversion, first, because of the added physiolog-

TABLE LXV

THE RELIABILITY OF THE DIFFERENCES BETWEEN THE CORRELATION OF CRITERION AND TEST SCORES, WHEN THE CORRELATIONS OF THE INTROVERT AND EXTRAVERT GROUPS ARE COMPARED. RELIABILITY IS EXPRESSED AS AN EXPERIMENTAL COEFFICIENT, AND AS THE NUMBER OF CHANCES PER THOUSAND THAT THE OBSERVED DIFFERENCE IS NOT A CHANCE DIFFERENCE

CRITERION AND	CORRELATION		DIFF.	S.E. DIFF.	E. C.	CHANCES PER 1,000
	INTRO-VERT	EXTRA-VERT				
1. Multimental T Score ..	− .023	.038	.061	.1378	.443	671
2. Mean Association Time.	.150	.121	.029	.1320	.219	587
3. Median Association Time	.082	.157	.075	.1371	.547	708
4. 90 Percentile Association Time	.133	.047	.086	.1378	.624	734
5. Response Failures	− .008	.004	.012	.1400	.085	534
6. Reproduction Failures .	− .016	.046	.062	.1385	.447	673
7. Word Range	.067	.004	.063	.393	.452	675
8. Contrast Responses ...	− .038	.006	.044	.385	.3177	625
9. Ink Blot Nouns	− .166	− .112	.054	.1320	.409	659
10. Ink Blot Verbs	− .156	.007	.163	.1379	1.182	881
11. Unspeeded Motor Output	− .052	.050	.102	.1385	.736	769
12. Speeded Motor Output.	− .178	− .08	.070	.1357	.515	697
13. Total Motor Output ...	− .111	− .041	.070	.1378	.507	694
14. Kinetic Reserve	.003	− .145	.148	.1371	1.079	860
15. Multiple Choice	.097	.084	.013	.1385	.093	537
16. Weight Selection	.302	− .018	.320	.1329	2.407	992
17. Weight Suggestibility ..	− .121	.006	.127	.1386	.916	820
18. Motivated Choice	− .133	− .015	.118	.1386	.851	803
19. Picture Questions	− .010	.075	.085	.1393	.610	729
20. Color-Naming, 1st Trial	.014	.154	.140	.1379	1.015	845
21. Color-Naming, 2nd Trial	.056	.110	.054	.1378	.391	652
22. Color-Naming Total ...	.019	.166	.147	.1371	1.072	858
23. Trend Questionnaire ...	.195	− .124	.319	.1357	2.350	991
24. Conditioned Affect	.008	− .051	.059	.1393	.423	664

ical maturity with its attendant complications; and, second, because of the increased range of social responsibilities and contacts which increased age implies. Maturity may tend either to exaggerate or to obliterate the differences in responses noted in the preceding paragraphs. The question can be attacked from a number of different angles. From Table LXVI, the following facts are evident:

a. The correlation between chronological age and criterion is negligible. There is no significant tendency for the factor of age to affect the ratings which were given by the judges who rated these children.

TABLE LXVI

THE CORRELATION OF TEST SCORES WITH AGE

AGE AND	INTROVERTS	EXTRAVERTS	COMBINED
Criterion	− .013	.125	.049
1. Multimental T Score	.086	− .012	.031
2. Mean Association Time	− .015	.041	.050
3. Median Association Time	.055	.042	.069
4. 90 Percentile Association Time	.063	.028	.070
5. Response Failures	.041	.030	.050
6. Reproduction Failures	.134	.049	.092
7. Word Range	− .079	.163	.012
8. Contrast Response	.117	.024	.027
9. Ink Blot Nouns	− .011	.067	.025
10. Ink Blot Verbs	− .027	.038	.047
11. Unspeeded Output	.109	.062	.062
12. Speeded Output	.181	.180	.140
13. Total Motor Output	.084	.111	.116
14. Kinetic Reserve	.024	.017	.028
15. Multiple Choice	− .065	− .054	− .086
16. Weight Selection	− .020	.074	.045
17. Weight Suggestibility	− .182	− .214	− .216
18. Motivated Choice	− .021	.021	.001
19. Picture Questions	− .108	.054	− .055
20. Color-Naming, 1st trial	− .309	− .347	− .330
21. Color-Naming, 2nd trial	− .405	− .309	− .312
22. Color-Naming Total	− .276	− .372	− .303
23. Trend Questionnaire	− .074	.049	.040
24. Conditioned Affect	− .103	.078	− .005

b. The correlations between ages and the several test scores are for the most part negligble, whether the groups are considered together or separately. Only in the case of variables 12, 13, 15, 17, 20, 21, and 22 is there a tendency for age to show any definite trend toward a significant correlation. Manual output tends slightly to improve with age in both contrasted groups, while the choice of pictures and more especially the naming of colors tends to be somewhat retarded with increasing age. Furthermore, Table LXVI shows that the functions which show the significant biserial correlations between criterion and test score quite uniformly have low correlations with age.

c. Partial correlations between test score and criterion with age constant were computed, as were also multiple correlations of criterion with test score and age combined. The results were not significant, as might be expected, and for lack of space, they are not reported here.

We may conclude, therefore, that with the exceptions noted, age, within the limits here considered, has little or no bearing on the test responses of introverts and extraverts, and that the condition exists quite apart from considerations of chronological maturity.

III. The Influence of Intelligence

It may be that intelligence is a determining factor in the differences in response that have been noted earlier in this study. The question can be approached in the same way in which the problem of age was approached. Table LXVII presents the data needed for the study. From a study of this table, the following conclusions may be drawn:

a. The correlation between criterion and intelligence scores is negligible, save for the combined groups where it is significant.

(*a*) For the introvert group $r = -.023 \pm .066$.

(*b*) For the extravert group, $r = .038 \pm .066$.

(*c*) For the combined group, the biserial $r = -.339 \pm .054$.

In the case of the correlation of the separate groups, the coefficient has suffered attenuation because of the narrow range of the criterion ratings. In the case of the combined group, the extreme dichotomy of the criterion ratings has produced a cor-

relation which is perhaps spuriously high. The nature of the ratings was such as to make it likely that the Biserial r formula would give a closer approach to the true coefficient than the Pearson formula, because it is adapted to the study of situations in which one variable consists of a dichotomy imposed on a normal frequency distribution. It may be assumed that the Biserial r applies fairly to the present situation. If this be so, then there is a small but significant negative correlation between criterion and intelligence scores.

The exact nature of this correspondence is, however, not so

TABLE LXVII

THE CORRELATION OF TEST SCORES WITH INTELLIGENCE

INTELLIGENCE AND	INTROVERTS	EXTRAVERTS	COMBINED
1. Criterion Rating	− .023	.038	− .267
2. Age	.086	− .012	.031
3. Mean Association Time	− .135	− .162	− .274
4. Median Association Time	− .156	− .122	− .227
5. 90 Percentile Association Time	− .069	− .121	− .194
6. Response Failure	− .053	− .096	− .039
7. Reproduction Failure	− .051	− .145	− .088
8. Word Range	.094	.103	.122
9. Contrast Response	.036	.166	.176
10. Ink Blot Nouns	.045	− .048	.065
11. Ink Blot Verbs	− .214	.018	− .100
12. Unspeeded Motor Output	− .165	− .018	− .031
13. Speeded Motor Output	− .061	.048	.069
14. Total Motor Output	− .132	− .010	− .001
15. Kinetic Reserve	.164	.024	.128
16. Multiple Choice	.039	− .105	− .085
17. Weight Selection	.081	.001	.031
18. Weight Suggestibility	− .053	− .095	− .039
19. Motivated Choice	− .173	− .038	− .181
20. Picture Questions	− .257	− .006	− .124
21. Color-Naming, 1st Trial	− .273	− .200	− .327
22. Color-Naming, 2nd Trial	− .397	− .332	− .348
23. Color-Naming, Total Time	− .267	− .335	− .322
24. Trend Questionnaire	.100	.068	− .041
25. Conditioned Affect	.049	.009	.017

clear. It has been shown in an earlier chapter that while success in the multimental test appears to depend directly on ability to make quick and positive decisions, it is precisely in this trait that the introvert group differs from the extravert. The introvert makes only .782 times as many changes in his test paper as the extravert, but he fails to attempt 2.265 times as many problems as the extravert. "Slow but sure" is the watchword of the introvert. Unfortunately, it does not lead to high scores on intelligence tests. Whether this tendency to deliberate well-considered response is a matter of habit or of organic structure or of infantile conditioning does not appear from the data of the intelligence test.

b. The significance of differences of speed in response is again shown by a consideration of the correlations between speed of response to both the word association test and the color-naming test with intelligence. In both cases a significant negative correlation is indicated. The slowly responding child tends to have a low intelligence score. There is no other consistent and significant correlation between intelligence score and test scores, whether the groups be considered separately or in combination.

c. As in the case of age, so here, partial correlations between test score and criterion with intelligence held constant were computed, as were also multiple correlations of criterion with test score and intelligence combined. The results were for the most part not significant, and because of limitations of space they are not reported here.

With the possible exceptions noted above, intelligence, in so far as it was here measured by the Multimental Test used, cannot be said to be an important function of any of the test scores presented in this study. The two contrasted groups, however, presented certain apparent differences in the trend of the correlation between test score and intelligence. In Table LXVIII, these differences are analyzed as to their reliability. In most cases, the sigma of the difference is so large as to deprive the difference of any reliable significance.

Only the differences in tendency which are indicated in connection with variables 5, 8, 10, 11, 14, 15, 18, and 19 appear to be worthy of further investigation. It would almost seem as though the factor of intelligence played a different rôle in the

TABLE LXVIII

THE EXPERIMENTAL COEFFICIENT OF THE DIFFERENCES BETWEEN THE CORRELATIONS OF MULTIMENTAL T SCORES AND TEST SCORES, WHEN THE CORRELATIONS OF INTROVERT AND EXTRAVERT GROUPS ARE COMPARED. RELIABILITY IS EXPRESSED IN CHANCES PER THOUSAND THAT THE DIFFERENCE IS RELIABLE

T SCORE AND	CORRELATION		DIFF.	S. E. DIFF.	E. C.	CHANCES PER 1,000
	INTRO-VERT	EXTRA-VERT				
1. Age	.086	− .012	.098	.1393	.703	759
2. Mean Association Time	− .135	− .162	.027	.1320	.204	581
3. Median Association Time	− .156	− .122	.034	.1320	.258	602
4. 90 Percentile Association time	− .069	− .121	.052	.1378	.377	647
5. Response Failures	− .053	.096	.043	.1386	1.068	857
6. Reproduction Failures	− .051	− .145	.094	.1371	.686	754
7. Word Range	.094	.103	.009	.1378	.065	526
8. Contrast Responses	.036	.166	.130	.1371	.948	828
9. Ink Blot Nouns	− .048	.045	.093	.1386	.671	749
10. Ink Blot Verbs	− .214	.018	.232	.1358	1.708	956
11. Unspeeded Motor Output	− .165	− .018	.147	.1379	1.066	857
12. Speeded Motor Output	− .061	.048	.108	.1386	.779	782
13. Total Motor Output	− .132	− .010	.122	.1386	.880	810
14. Index Kinetic Reserve	.164	.024	.140	.1371	1.014	845
15. Multiple Choice	.039	− .105	.144	.1378	1.045	852
16. Weight Selection	.081	.001	.080	.1393	.574	716
17. Weight Suggestibility	− .053	− .095	.042	.1386	.303	619
18. Motivated Choice	− .173	− .038	.135	.1371	.985	838
19. Picture Questions	− .257	− .006	.251	.1351	1.858	969
20. Color-Naming, 1st Trial	− .273	− .200	.073	.1316	.555	711
21. Color-Naming, 2nd Trial	− .397	− .332	.065	.1210	.537	704
22. Color-Naming Total Time	− .267	− .335	.068	.1273	.534	703
23. Trend Questionnaire	.100	.078	.032	.1386	.231	591
24. Conditioned Affect	.049	.009	.040	.1393	.416	661

two contrasted groups, facilitating the response of one type and retarding that of the other. The data are not finally conclusive.

IV. Significant Elements

From the data at hand, it is possible to indicate tentatively some of the test elements which appear to have diagnostic significance. Many of the correlations between criterion and test elements were small and quite meaningless, and further consideration would be unprofitable. Table LXIX presents the variables which were correlated with the criterion to a significant degree, For reasons stated earlier in this study, the coefficients given are based on the Biserial *r* formula.

TABLE LXIX

The Test Elements Having Biserial Correlation Coefficients With Criterion Above .25, Together With Their Standard Errors

Variable	Biserial $r \pm \sigma r$
1. Mean Time*	.6196 ± .061
2. T Score	− .339 ± .079
3. Contrast Response	− .406 ± .076
4. Ink Blot Nouns	− .386 ± .077
5. Speeded Output**	− .328 ± .080
6. Trend Questionnaire	.496 ± .070
7. Multiple Choice	.257 ± .083
8. Conditioned Affect	− .313 ± .080

* Scores have a self-correlation of .974 when odd-numbered items are correlated with even-numbered items.

** Scores have a self-correlation of .935 when score of first trial is correlated with score of second trial.

The first six of these correlations are derived from scores of an objective character. The sixth has been shown to have a high self-correlation, and is fairly consistent with the observed traits of a number of our cases. The eighth is based entirely on subjective evidence, and is not subject to any sort of control. It may for that reason be ignored for the present. The relationships of the remaining seven independent variables invite study. It should be of interest to know:

A. What are the intercorrelations between these variables? (Table LXX)

B. What effect does the elimination of the influence of the criterion have on the intercorrelations between the selected variables? (Table LXXI)

C. What effect does the elimination of each variable in turn have on the correlation between criterion and each of the variables? (Table LXXII)

D. What is the correlation of each of the seven variables with the criterion when the influence of the other six is held constant? (Table LXXIII)

E. What is the partial sigma of each of the seven test variables, when the influence of the other six is eliminated? (Table LXXIV)

F. What is the multiple correlation of the criterion with the best combination of scores on the seven test items? (Table LXXV)

G. What is the best weight of each of the seven test scores when these scores are thought of as determiners of introversion-extraversion?

The answers to these questions are herewith presented briefly:

A. Table LXX presents the answer to the first of these questions. Some of the interesting relationships which it shows are:

1. Variable 2 (mean time) has significant correlations with all the other variables, except possibly variable 6.

2. Variable 3 has substantial correlations with variables 2 and 4, but indifferent correlations with variables 5, 6, 7, and 8.

3. Variable 4 has meaningful correlations with variables 2 and 3 but low correlations with variables 5, 6, 7, and 8.

4. Variable 5 has definitely significant correlation with variable 2, and a mildly significant negative correlation with variable 8. With variables 3, 4, 6, and 7, the correlations are low.

5. Variable 6 has no meaningful correlations with any of the other variables of the series. If the validity of this variable could be increased, it would form an excellent base for a test battery for introversion-extraversion.

6. Variable 7 has a significant correlation with variable 2, but not with any of the others. It also might form the basis of a test battery.

7. Variable 8 is meaningfully correlated with variable 2 only, and might, therefore, if its own correlation with the criterion could be improved, be made an element in a test battery.

TABLE LXX

THE CORRELATIONS AND INTERCORRELATIONS OF SIGNIFICANT TEST ELEMENTS

	1. Criterion	2. Mean Time	3. T Score	4. Contrast Response	5. Ink Blot Nouns	6. Speeded Motor Output	7. Trend Questionnaire	8. Multiple Choice
1. Criterion ...		.6196	−.339	−.406	−.386	−.328	.496	.257
2. Mean Time .	.6196		−.274	−.400	−.504	−.153	.302	.25
3. T Score	−.339	−.274		−.257	.065	.069	−.041	−.085
4. Contrast Response .	−.406	−.400	−.257		.09	.101	−.069	−.092
5. Ink Blot Nouns	−.386	−.504	.065	.09		.177	−.128	−.196
6. Speeded Motor Output	−.328	−.153	.069	.101	.177		−.028	.054
7. Trend Questionnaire ..	.496	.302	−.041	−.069	−.128	−.028		.169
8. Multiple Choice ...	.257	.25	−.085	−.092	−.196	.054	.169	

B. The descriptive value of the test combinations above implied can be further estimated by noting how much of the intercorrelations noted in Table LXX is left if the influence of the criterion is eliminated, and Table LXXI will answer the question. The greater the loss in the intercorrelation caused by removing the influence of the criterion, the more certainly dc the intercorrelated elements really describe, within the limits of the original correlation, introversion-extraversion. The balance of the intercorrelation that remains is due to factors other than introversion-extraversion. The greater this balance is, the less certainly do the tests in question give a cross-section of the trait of introversion-extraversion since they cross each other outside of the zone of this trait. Certain facts are outstanding in Table LXXI.

1. The relationship between variables 2 and 3 seems definitely

TABLE LXXI

THE INTERCORRELATION OF VARIABLES WHEN THE INFLUENCE OF THE CRITERION IS HELD CONSTANT

VARIABLE BELOW WITH VARIABLE AT THE RIGHT CRITERION HELD CONSTANT	2. MEAN TIME	3. T SCORE	4. CONTRAST RESPONSE	5. INK BLOT NOUNS	6. SPEEDED MOTOR OUTPUT	7. TREND QUESTIONNAIRE	8. MULTIPLE CHOICE
2. Mean Time ..		− .0867	− .2069	− .3657	.0677	.0078	.1197
3. T Score	− .0867		− .4590	− .0759	− .0475	.1555	.0023
4. Contrast Response ..	− .2069	− .4590		− .0791	− .0373	.1668	.0139
5. Ink Blot Nouns	− .3657	− .0759	− .0791		− .0578	.0792	− .1086
6. Speeded Motor Output .	− .0677	− .0475	.0373	.0578		.1642	.1515
7. Trend Questionnaire ..	.0078	.1555	.1663	.0792	.1642		.0495
8. Multiple Choice	1197	.0023	.0139	− .1086	.1515	.0495	

to be dependent on introversion-extraversion rather than on intelligence.

2. The relationship between variables 3 and 4 indicates that apart from introversion-extraversion the unintelligent give more contrast responses than the intelligent. In the original zero order correlations, the introverts had the smaller number of contrast responses, even though they tended to be slightly less intelligent than the extraverts. Possibly this intelligence test measures a special phase of intelligence, alertness or nimbleness, or verbal readiness.

3. Substantially, all the correlation between variables 2 and 5 remains when the criterion is held constant. These two functions have something in common other than introversion-extraversion.

4. Practically the same significant combinations of variables having low residual correlations with each other, but fair correlations with the criterion appear from Table LXXI as were seen in Table LXX.

5. It is to be noted that in the case of some of the partial correlations shown in Table LXXI there is an increase in the residual intercorrelation, while in others there is a decrease. The effect of introversion-extraversion is evidently of two types. Some relationships are attenuated by the presence of this variable in the human make-up; while others are facilitated, as in the case of the relationship between the trend questionnaire and mean reaction time. In the former case, the elimination of variation in introversion substantially increases the correlation; in the latter case, it all but eliminates or even reverses it.

C. Table LXXII presents the residual correlations which are left when each of the significant functions is removed in turn from the correlation of these functions with the criterion.

The relationships noted in Tables LXX and LXXI are essentially reasserted. The presence of some factors facilitates the correlation of a third factor with the criterion, while the presence of others attenuates it. For the purpose of easy comparison, the original "raw" correlation of each variable with the criterion is stated in the first column. The effect of eliminating the influence of each of the several variables in turn can be noted from the balance of the table.

1. Variable 2 clearly has something in common with each of the other variables, since eliminating them disturbs the original raw correlation, though for the most part only slightly, save possibly in the cases of variables 4 and 5.

2. Variable 3 shows two marked changes. Whatever it is that controls the correlation of T score with criterion is definitely related to whatever tends to prolong reaction times and to produce contrast responses.

3. Variable 4 shows similar dependence on variables 2 and 3. The presence of the first tends to increase the correlation with the criterion, the presence of the second attenuates it.

4. Variables 5, 7, and 8 show a definite relation to variable 2. Whatever it is that tends to produce slow responses in variable 2 undoubtedly has a determining influence in the correlation of these variables with the criterion.

5. Variable 6 is not so markedly dependent on variable 2 as the rest are, and it is not greatly influenced in its relation to the criterion by removing any of the other variables.

TABLE LXXII

First Order Partial Correlations of Each of the Significant Elements with the Criterion, when Each of the Other Significant Elements is Eliminated in Turn

Correlation of Criterion with Variable Below, when Variable at the Right is Held Constant	1. Criterion * (Original r_{12})	2. Mean Time	3. T Score	4. Contrast Response	5. Ink Blot Nouns	6. Speeded Motor Output	7. Trend Questionnaire	8. Multiple Choice
2. Mean Time..	.6196		.5821	.5458	.5335	.6099	.5675	.5935
3. T Score.....	−.339	−.2242		−.5020	−.3410	−.3557	−.3674	−.3294
4. Contrast Response..	.406	−.2199	−.5424		−.4042	−.3967	−.4292	−.3974
5. Ink Blot Nouns	−.386	−.1087	−.3877	−.3840		−.3528	−.3745	−.3541
6. Speeded Motor Output	−.328	−.3007	−.3245	−.3142	−.2850		−.3763	−.3543
7. Trend Questionnaire ..	.496	.4129	.5130	.5133	.4881	.5155		.4752
8. Multiple Choice ...	.257	.1344	.2434	.2413	.2004	.2912	.2024	

* Inserted for purpose of ready comparison.

D. Table LXXIII presents the partial correlation of criterion and test scores when they are freed, each in turn, from the influence of the other six variables.

Comparison of these partial coefficients with the corresponding

TABLE LXXIII

The Sixth Order Partial Correlation of Each of the Test Variables with the Criterion when the Influence of the Other Six Test Variables is Held Constant

Criterion and	
2. Mean Time	$r_{12\cdot345678} = .0627 \pm \sigma .0694$
3. T Score	$r_{13\cdot245678} = -.5017 \pm \sigma .0521$
4. Contrast Response.....	$r_{14\cdot235678} = -.5091 \pm \sigma .0516$
5. Ink Blot Nouns	$r_{15\cdot234678} = -.2434 \pm \sigma .0656$
6. Speeded Motor Output	$r_{16\cdot234578} = -.3443 \pm \sigma .0614$
7. Trend Questionnaire	$r_{17\cdot234568} = .5036 \pm \sigma .0520$
8. Multiple Choice	$r_{18\cdot234567} = .1364 \pm \sigma .0684$

raw coefficients given in Table LXIX reveals a number of interesting facts.

1. Apart from the other six variables, variable 2 is only slightly correlated with the criterion. Whatever it is that causes introverts to tend to respond slowly in the association test is largely identical with a composite of the factors which tend to produce significant scores in the other selected variables. When these are eliminated, little is left of the original correlation of .6196.

2. The correlation with multimental T score rises from —.339 to —.5017 when the influence of the other six test factors is held constant.

3. The correlation of the criterion with contrast response score is increased from —.406 to —.5091 when the influence of the remaining six factors is removed.

4. The correlation of ink blot nouns with criterion declines from —.386 to —.2434 when the influence of the other six contributing factors is eliminated. The remaining correlation is only slightly significant, but would perhaps be increased if more blots were used.

5. The correlation of speeded output with criterion is only slightly changed (from —.328 to —.3443) by holding the other six factors constant. Apparently, whatever determines the original correlation between hand motor speed and the criterion of introversion employed in this study does not significantly appear in the other functions included in this study.

6. The correlation between score on the trend questionnaire and the criterion is very slightly affected by holding the other six variables constant. The change from r=.496 to r=.5036 is negligible. Table LXX leads to the same conclusions.

7. The correlation between multiple choice score and criterion is reduced from .257 to .1364 when the other six test scores are held constant. The change is significant, and reënforces the conclusions reached on the basis of the intercorrelations noted in Table LXX, where significant intercorrelations were shown to exist between variables 8 and 2, 5, and 7, respectively.

E. The partial sigma of each of the seven test score distributions was computed and appears in Table LXXIV.

The partial sigma of the criterion scores freed from the rela-

TABLE LXXIV

THE PARTIAL SIGMAS OF THE FREQUENCY DISTRIBUTIONS OF THE SCORES OF EACH OF SEVEN TESTS AND OF THE CRITERION WHEN THE INFLUENCE OF THE OTHER SEVEN TESTS IS HELD CONSTANT

VARIABLE	PARTIAL SIGMA	RAW SIGMA*	RATIO
1. Criterion	$\sigma_{1\cdot 2345678} = 13.7946$	24.5499	.5619
2. Mean Time	$\sigma_{2\cdot 1345678} = .6683$	.9959	.6710
3. T Score	$\sigma_{3\cdot 1245678} = 6.2203$	8.3944	.7410
4. Contrast Responses	$\sigma_{4\cdot 1235678} = 6.1182$	8.7766	.6971
5. Ink Blot Nouns	$\sigma_{5\cdot 1234678} = 9.2114$	11.4370	.8054
6. Speeded Motor Output	$\sigma_{6\cdot 1234578} = 16.4113$	23.3513	.7028
7. Trend Questionnaire	$\sigma_{7\cdot 1234568} = 3.5662$	4.3822	.8138
8. Multiple Choice	$\sigma_{8\cdot 1234567} = 49.6394$	52.6008	.9437

* The sigma of the combined distributions is used.

tions of the other variables shows a significant attenuation. The ratio of the raw to the refined measure is substantially .56, a definite improvement.

F. The multiple correlation coefficient of the criterion with the best combination of the seven test scores, using the formula,

$$R_{1\cdot 2345678} = \sqrt{1 - \frac{\sigma^2{}_{1\cdot 2345678}}{\sigma^2{}_1}},$$ is .8272.

When checked by the alternative formula,

$$R_{1\cdot 2345678} = \frac{\sqrt{1 - (1 - r^2{}_{12})(1 - r^2{}_{13\cdot 2})(1 - r^2{}_{14\cdot 23})(1 - r^2{}_{15\cdot 234})}}{(1 - r^2{}_{16\cdot 2345})(1 - r^2{}_{17\cdot 23456})(1 - r^2{}_{18\cdot 234567})}$$

it is .8275.

The relative influence of the several tests of the series may be seen from Table LXXV.

TABLE LXXV

THE MULTIPLE CORRELATION COEFFICIENTS OF THE CRITERION WITH TEST SCORES WHEN TEST SCORES ARE ADDED ONE BY ONE

VARIABLES	COEFFICIENT
$R_{1\cdot 78}$	.5256
$R_{1\cdot 678}$	.6171
$R_{1\cdot 5678}$	.6634
$R_{1\cdot 45678}$	.7347
$R_{1\cdot 345678}$	.8268
$R_{1\cdot 2345678}$	.8275

G. In score form the regression equation of the criterion on the sum of the best weighted scores of the seven tests is as follows:

$$X_1 = 1.294\ X_2 - 1.1126\ X_3 - 1.1479\ X_4 - .3645\ X_5 - .2894\ X_6 + 1.9848\ X_7 + .0379\ X_8 + 170.66$$

On the basis of this equation, it becomes possible to estimate the relative weights of the seven significant variables:

1. Variable 2, mean time on the association test, has value in indicating tendency toward introversion or extraversion. Whatever it is that controls the rate of responding to stimulus words is somehow related to the essence of introversion-extraversion. The value of this test as an indicator is approached only by the Trend Questionnaire.

2. Variable 3, multimental T score, has negative value as an indicator of trend and occupies the median place in the series. The question of the real significance of this test as a test of intelligence has been raised elsewhere. It may be that introversion-extraversion sometimes plays as prominent a part in determining multimental scores as does intelligence, whatever that may ultimately be determined to be. Possibly the same elements enter into the validity of other intelligence test scores and might account for some of the low correlations between apparent ability and actual performance.

3. Variable 4, contrast responses, occupies the third place in the series of score-weights. The distribution of scores is sufficiently differential to give a real value to contrast response, and scores are in the nature of a by-product of the free association test, requiring no addition of either time or effort.

4. Variable 5, ink blot nouns, adjectives and adverbs, holds fifth place in the series of weights. Considering the size of the test scores, the coefficient of —.3645 makes this test appear of considerable importance, and we may fairly conclude that a tendency to respond sparingly with substantives and modifiers to ink blot stimuli is indicative of a trend toward introversion, while the tendency to respond freely indicates a tendency toward extraversion. The very definition of introversion suggests such a tendency. The response made by the introvert tends to be in the direction of socially inadequate subjective and organic responses, which only incidentally and sketchily find an echo in speech response.

5. Variable 6, speeded motor output, occupies the sixth place in the series of weights, though the relatively large raw scores make the test really more significant as a component of the composite score than would at first appear. Whatever it is that constitutes introversion, whether it be an acquired habit pattern, or whether it be a kind of fixed attitude toward the objective world, or whether it be conditioned by an inherited organic peculiarity, the fact seems fairly clear that it predisposes the subject to a slower rate of manual response to the conditions of this test.

6. Variable 7, trend questionnaire, patterned after Woodworth, is first in the series of weights. The narrow range of scores, however, weakens the value of the questionnaire in its present form. There should be no real difficulty in expanding it and, accordingly, also the scores. It is significant, as has been already pointed out, that the trait of introversion tends so definitely to coexist with an admitted awareness of the presence of neurasthenoid, psychasthenoid, and autistic symptoms. It is also significant that many of these symptoms are described by medical authorities as chronic in nature, constituting permanent earmarks of the personality make-up. Introversion, at least in its more marked forms, is probably not a transitory pattern of behavior but a permanent bent or mould.

7. Variable 8, multiple choice time, is last in the series. The raw scores are relatively large, however, and the weight of .0379 gives to the test a definite significance. Probably the technique of administering and scoring the test could be changed so as to isolate the significant factors more effectively, and thereby to increase the weight of these scores.

A consideration of the algebraic signs of the weights above discussed may be significant. All performances which imply deliberation, slow, retarded response, speed scores in units of time are weighted positively. All scores which are in terms of output, whether of speech or movement are weighted negatively. The introvert moves more slowly and less productively than the extravert. Either the introvert total response to stimuli of the sort used in this study is both absolutely and relatively less than is that of the contrasted children, or else the response is diverted into covert organic channels, which do not lend themselves to estimation by the methods here employed.

There may be a tendency for introvert individuals to divert responses into parasympathetic channels [81], which would result in precisely those inhibitions and facilitations of organic functions which lie at the basis of the neurasthenoid trends of which these children complain. To date, however, no really reliable or effective technique has been developed for measuring these covert responses. Mosso's experiments [82] reported by Goddard suggest one method of approach, but the method is hardly available with school children. The plethysmograph and the galvanometer have possibilities, but their readings are shrouded in the dense fog of extra-conscious responses to incidental unnoticed stimuli. The Cardiogram has possibilities, especially in its more recent forms, in which the errors due to the inertia of moving parts has been all but eliminated. A study of the behavior of the sphincter muscles of the iris is suggested as offering possible avenues of approach to the problem.

CHAPTER XVI

GENERAL CONCLUSIONS

Limiting Factors

The foregoing study is fragmentary, and open to serious challenges:

1. The number of cases is small, though large enough to make the results statistically defensible.

2. The persons who acted as judges in the selection of the subjects included in the study probably differed somewhat in their interpretation of the traits named in the trend rating sheet, and probably also in the adequacy of their acquaintance with the children to be rated. It is believed, however, that the nature of the instructions was such as to reduce these difficulties to the irreducible minimum.

3. It is possible that at the time of examination some of the subjects in both groups were in a state of temporary psychic stress which distorted their responses. The effect of such deviations from normal trend would be, on the whole, to conceal the actual differences between the responses of the two groups. This is especially true of the expansive states of some of the introverts and of the depressed states of some of the extraverts. Their presence would tend to obliterate the differences noted rather than to exaggerate them. The differences noted exist not because of them, but in spite of them.

4. It is possible that the sex of the experimenters exerted some subtle influence in determining the quantity and quality of the responses noted. All of the examiners save one were women. A careful comparison of the results secured by the male examiner with those of the six female examiners does not indicate any marked differences in the responses.

5. The battery of tests employed probably was neither ideally complete nor ideally appropriate. The study represents a pioneer venture, and is presented as such. Each child examined was in

the presence of the examiners for an aggregate period of nearly two hours, and the tests used were selected empirically for the reasons discussed earlier. The tests that appear to possess diagnostic value could probably be given within an hour, perhaps in less time.

Conclusions

With the reservations above noted, the following conclusions seem warranted:

1. There are definite measurable and reliable differences between some aspects of the behavior of introvert and extravert children between the ages of twelve and eighteen.

2. These behavior differences involve the speed of manual movement, the speed of aesthetic decision, the speed of responding to verbal stimuli, the quality of the response to verbal stimuli, the quality and quantity of response to ink blots, the ability to make a high score on the multimental test, the tendency to be aware of neurasthenoid, psychasthenoid, and autistic symptoms or habits, and probably the amount of emotional output.

3. The tendency for introverts and extraverts to present the characteristic trends noted above is not affected by chronological age, within the limits here considered.

4. It is doubtful whether the behavior trends are greatly affected by differences in intelligence if those differences lie within the ordinary limits of "normal intelligence."

5. In addition to the statistically established differences, there is a mass of evidence of an unscored type relative to emotional responses. Introverts make the impression of having a flatter, less vivid affect life than do extraverts. In any case, their overt expressions of affect were far less numerous, and far more rigorously censored than were those of the extravert group.

Related Problems

The conclusions thus reached leave untouched a number of problems germane to the questions at issue.

1. Nothing that was observed during the testing throws any clear light on the time of life at which the tendencies noted came into existence. Between the limits of twelve and eighteen, there is no correlation between age and introversion or extraversion.

The trends are already present at age twelve. How much before that they arise is a question for further study.

2. No facts came to light with reference to the question of the acquired or inherited nature of introversion or extraversion. The weight of authority is in favor of an hereditary background. It is, however, conceivable that early conditioning may be a potent factor, even apart from heredity.

3. The problem of the meaning of intelligence scores and of the relationships between such scores and teachers' estimates of achievements on the one hand and actual achievement scores on the other is one full of deep significance if children actually do differ in their dynamic drives as definitely as seems to be indicated by the findings of this study. Perhaps an I.Q. is a composite of many hidden functions.

4. Many aspects of vocational guidance are intimately related to our findings, and merit intensive study.

5. Some of the problems of mental hygiene might well be approached from the angle of this study. It would conceivably be as fruitful for humanity if a reliable index of trend could be developed as it has been to establish the rate of intellectual maturation.

6. The tests employed in the present study need to be studied further from the point of view of reliability. They probably are not in their best final form. To develop a reliable scale for the measurement of introversion-extraversion constitutes the next step in the investigation.

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He was instructor in Hebrew during his senior year at Brown University; taught Latin and Greek from 1899 to 1901 at Indian University, at Bacone, Indian Territory, now Oklahoma; served as professor of Greek and Education at Ottawa University, Ottawa, Kansas, from 1901 to 1907, serving as acting president from 1905 to 1906; and was called to the University of Kansas in June, 1907, to serve as associate professor of Education. He was made full professor in 1914, acting dean of the School of Education in 1923, and dean in 1927. The writer has lectured extensively throughout the Middle West before teachers and educational gatherings.

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